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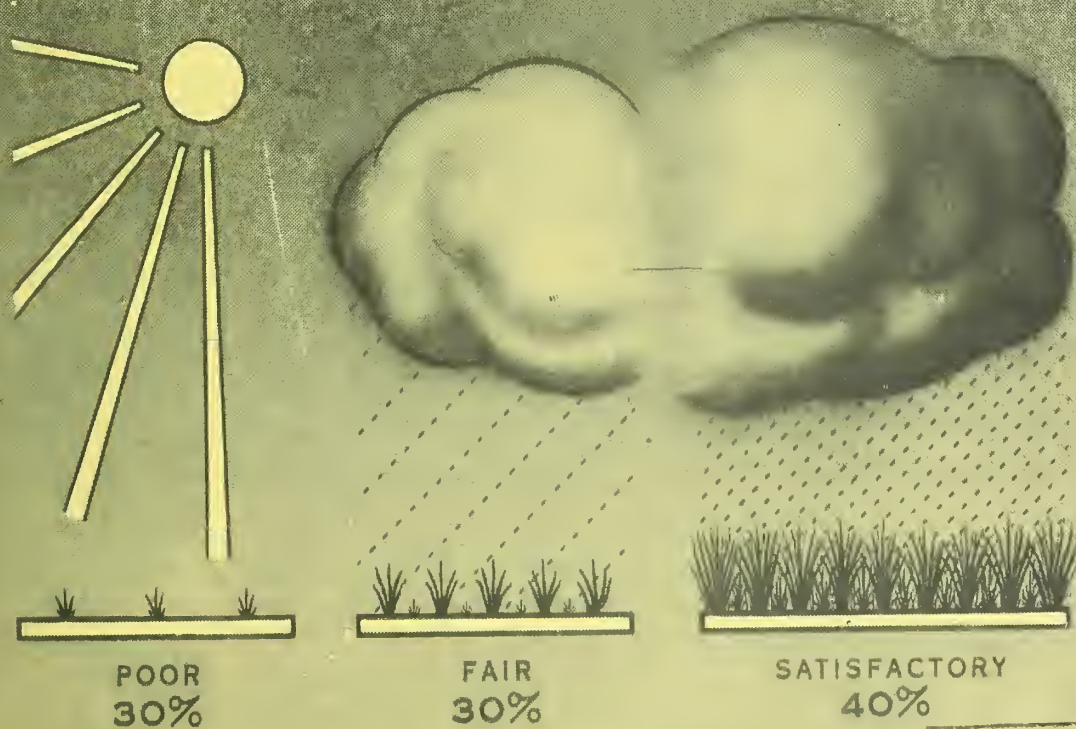
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# CLIMATE:

## THE *Limiting* FACTOR in *Hand County Agriculture*



by DELBERT C. MYRICK

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U. S. DEPARTMENT OF AGRICULTURE, BUREAU OF AGRICULTURAL ECONOMICS  
IN COOPERATION WITH SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION  
WASHINGTON, D. C.  
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## PREFATORY NOTE

Hand County, in the middle of the Central South Dakota area, is the first unified planning county in the State. Through its planning committees, the county has requested research assistance in tackling its problems. The immediate problem is to make adjustments that will best support the agricultural population of the county within the framework of present institutions, land use, prices, and population pattern. The basic problem and ultimate goal of adjustment is to provide for each farm family the opportunity to attain a reasonable level of living.

Planning for the future requires a knowledge of past experience with climate, yields, prices, farm organization, farm income, that is, anything that will throw light on existing conditions. The plans must consider all the possible situations as regards these items, and the most likely combinations of them. Effectiveness of plans is dependent upon a knowledge of reactions in the past. If danger signs are recognized, maladjustments may be forestalled by group action taken at opportune times.

In the Central South Dakota area the transition is made from corn-belt types of farming to the extensive farming and ranching of the north and west. This transitional agriculture is not a fixed type. Its reaction to changes in prices and price-cost relationships, and to the widely varying climatic conditions, intensify the problems of agricultural planning and adjustment. At times the area has prospered, farms have been improved, new capital has flowed in, farmers have been well off, the number of farms has increased. At other times the area has been in distress, farmers have been in need, farms have been abandoned, creditors have become unwilling land owners, and invested capital has been lost. Today the effects of the latter conditions are more evident. Agriculture in the area seems to need some major adjustments in order to support its people in difficult times as well as in good.

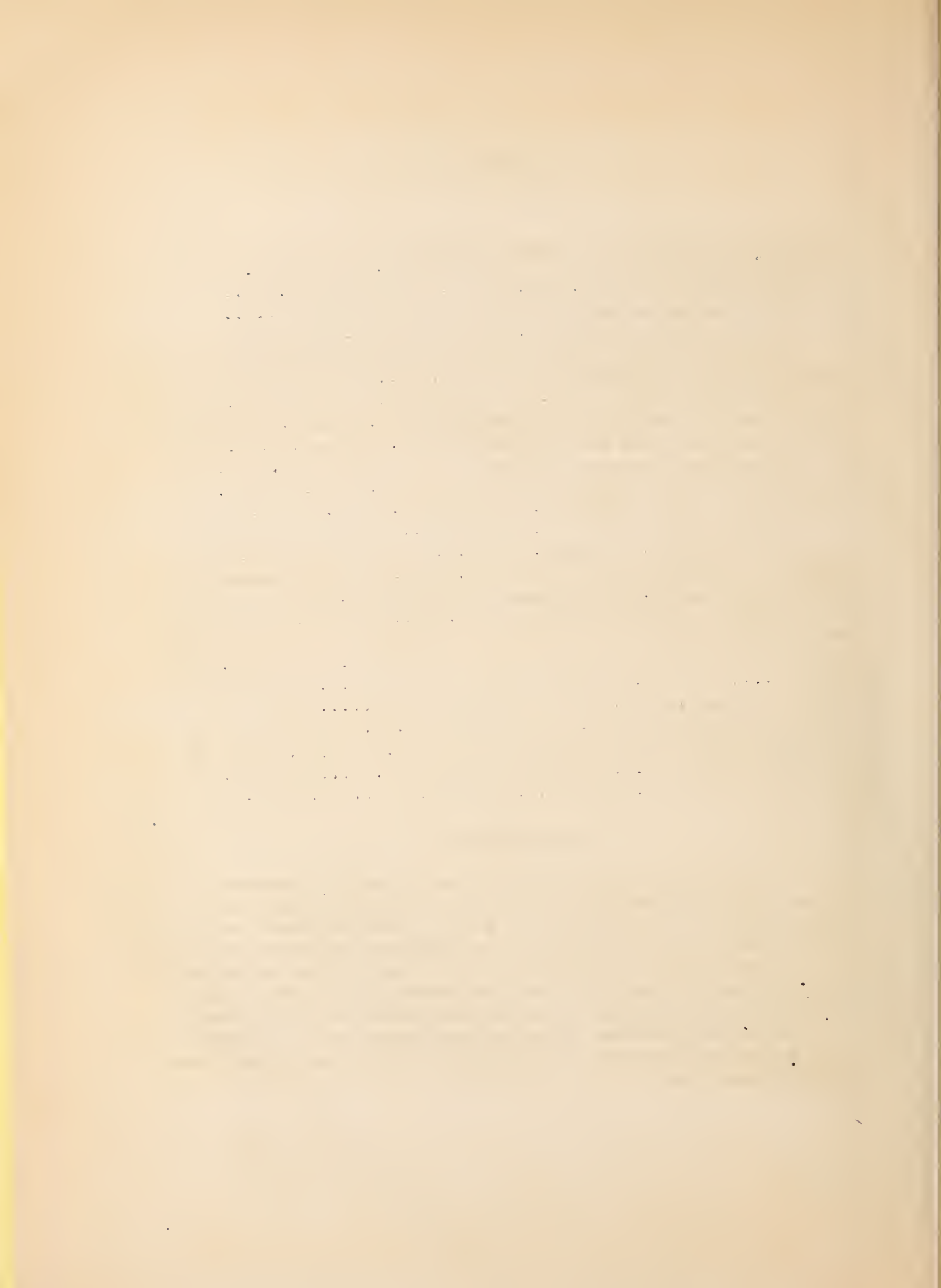
This report on climate is intended as the first of several containing basic planning material. These will furnish considerable detail that will not be included in the report on farm adjustments.

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## CLIMATE: THE LIMITING FACTOR IN HAND COUNTY AGRICULTURE

By

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Bureau of Agricultural Economics

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### CLIMATIC VARIABILITY IS NORMAL EXPECTANCY

Climate in Hand County is characterized by extreme variability. Change from year to year stands out in the experience with climate in Hand County and "Central Dakota". Change is not meant to imply a changing climate, but means that each year is different and has characteristics not appearing in definite sequence to those of any other year. A "normal" level of weather obviously does not exist, but perhaps after the past is reviewed, plans for the future will provide for the ups and downs to make their consequences less severe.

Precipitation is the primary limiting factor in crop and grass production. As precipitation from year to year varies greatly and as droughts constitute a real hazard, a careful examination of the climate needs to be made in studying the agriculture of the area. Although precipitation is the most important characteristic to consider, temperatures and winds must not be overlooked. Hail, dust storms, length and severity of winters, frosts, water supplies and conservation, weeds, and pests are other items to be taken into consideration.

This report sets forth some facts concerning the climate of Hand County, in order that the characteristics of this climate may be given full consideration in planning for the best agricultural use of the area. It is an effort to bring into view at one time all the phases of that climate. For the person unfamiliar with the area a warning should be included to the effect that his perspective should not so govern his reaction to the information presented that he will be inclined to condemn the area for agriculture. That there have been periods of distress in the area is not to be denied, and it is true that the usual direct cause is climate, though this is intensified by prices and other factors. Most problems caused by climate arise from the adjustment to subhumid farming that occurs whenever good years appear. In those times enough consideration is not given to the highly variable nature of the climate and the fact that dry years are likely to occur again. If the climate can be well judged, and the intensity and kind of farming regulated to it, agriculture will always be attractive and profitable in Central Dakota.

"Central Dakota is a large term, but is used here to cover the divide and prairies on either side of it, between the James and Missouri Rivers. This section of country has been called the debatable ground of the public land settlement of South Dakota. People have said they would never have rain there in sufficient quantities



to harvest a crop; the soil was principally 'gumbo' anyhow; and for these and a multitude of other reasons it could never become an agricultural region. They used to spin these same yarns about all of Dakota, but by degrees they have been forced west and further on with their doleful predictions, until now we have them landed on the other side of the Big Muddy .... Central Dakota has proved its title as an agricultural section possessing every capability for grain and stock farming, and will steadily increase in prosperity." 1/

Written in 1889, this is applicable to the history of Hand County and the rest of Central South Dakota from 1881 to 1940. It refers to some of the problems encountered, and is full of the optimism and enthusiasm that characterized settlement and that have continued through sixty years of experience.

#### PRELUDE (Prior to 1881)

In 1885, "one of the driest years Dakota has known", Lieutenant Warren explored south from Pierre to Fort Kearney, Nebraska, reports the historian, Doane Robinson. 2/ Severe drought was observed by white men in the Territory before the first permanent settlements. However, little information is available on climate in Central South Dakota before 1882.

The oldest official and continuous weather records that might throw some light on conditions in South Dakota are those from Fort Snelling, Minnesota, now published in Weather Bureau Records as a part of the St. Paul series. 3/ These begin in August 1836, or with the 1837 crop year (fig. 1). When this series is compared with that of Huron, S. Dak., beginning in 1881, enough similarity is seen to justify some use of the St. Paul record. It is almost always above the Huron level, which is to be expected. While the two series do not move up and down in unison, they agree very closely on the "families of droughts", that is, on the occasions when several dry years appear in succession. For instance, in both areas precipitation started a decline in 1883 that prevailed generally until 1896. Declines from 1920 to 1930, followed by extreme droughts, occurred in both areas. The relationship appears to be that families of droughts in St. Paul are associated with families of droughts at

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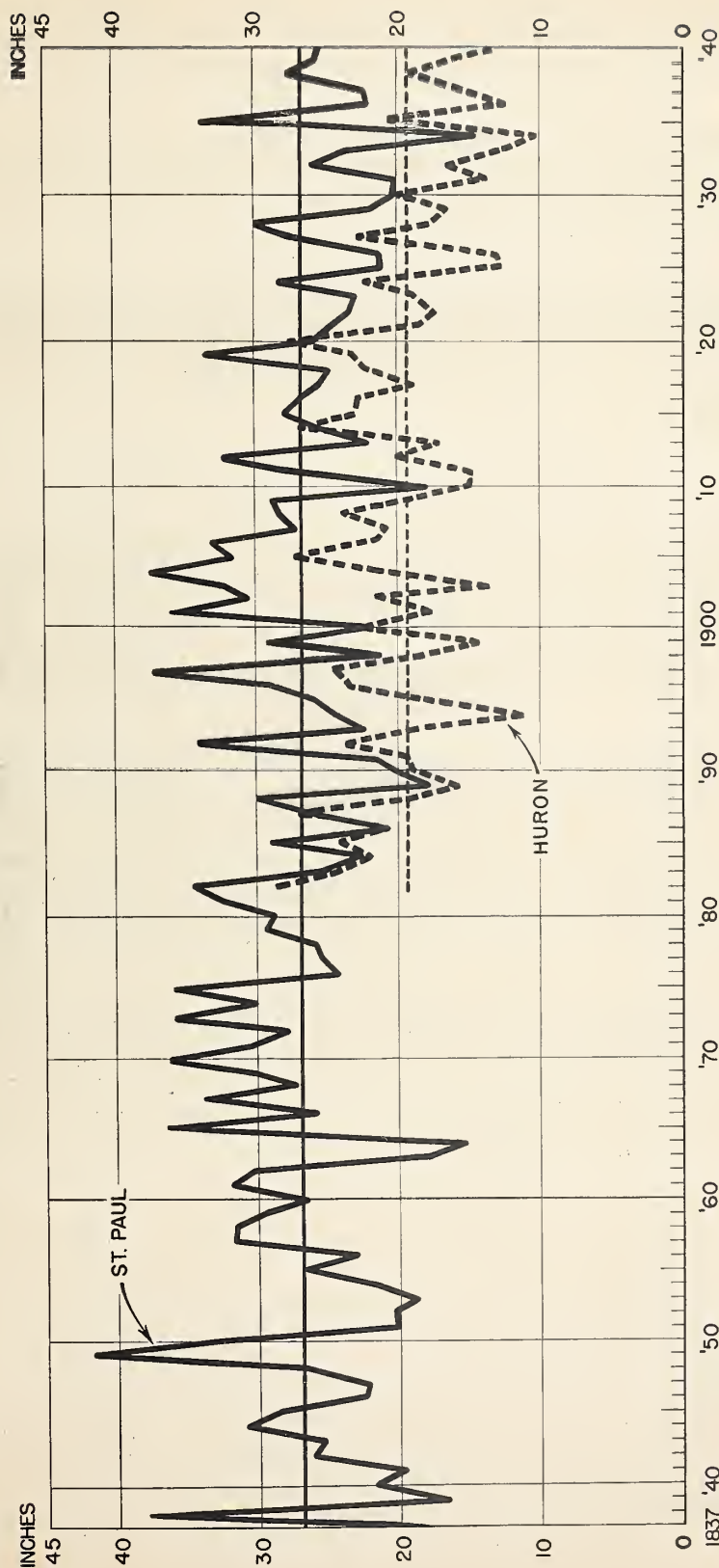
1/ Hagerty, Frank H. The Territory of Dakota. Aberdeen, South Dakota, 1889. Part III, p. 55. ("Big Muddy" is a common name for the Missouri River.)

2/ Robinson, Doane. History of South Dakota. Indianapolis, Indiana, 1904. Vol. I, p. 156.

3/ U.S. Weather Bureau, Climatic Summary of the United States, data herein from establishment of stations until 1950 inclusive; Section 46 - Southeastern Minnesota, Washington, D.C.; U.S.D.A., 1934; also U.S. Weather Bureau, Climatological Data, Minnesota Section, annual, since 1931.



# CROP YEAR PRECIPITATION, ST. PAUL, MINNESOTA, 1837-1940 AND HURON, SOUTH DAKOTA, 1882-1940



SOURCE: U.S. WEATHER BUREAU

PREPARED BY: U.S. DEPARTMENT OF AGRICULTURE  
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FIGURE 1

Huron. Drought periods from 1839 to 1848, from 1851 to 1857, and in 1863 and 1864 at St. Paul indicate that droughts may have occurred in Central South Dakota during the same periods.

Further comparison shows that in South Dakota the periods of high precipitation are more frequently interrupted by dry years, and that the dry periods are more persistent. This would indicate even more drought there than at St. Paul.

Settlements in the southern and eastern part of South Dakota have left some records of the effect of climate on crops, and military expeditions and affairs with the Indians have also left occasional notes of importance, available now in histories, biographies, and other accounts.

### Great Storms and Drifting Snows

The few settlers along the Missouri River near Yankton experienced an abundant harvest in 1862. This followed a hard winter of "great storms and drifting snows", and a flood when the ice in the river broke up in the spring. It was probably quite similar to the experience of 1881 which immediately preceded settlement of Hand County.

"The year 1863 was one of the driest seasons Dakota has ever experienced since white men settled there. There was an interval of fifty days without rain." <sup>4/</sup> In that year a group of Indian captives was taken by Sully to the Crow Creek Reservation, near Fort Thompson on the Missouri River below Pierre. Referring to their serious shortage of food, Doane Robinson says, "The awful drought of the year had completely destroyed anything in the shape of crops in the vicinity of the reservation. Owing, too, to the dry weather, the Missouri had dwindled to a point where navigation was utterly impracticable." <sup>5/</sup> The latter comment indicates that deforestation and cultivation by the white men were not essential to the drying up of streams, but great droughts could do the job alone. In this case it was only the next year following a great flood.

The situation persisted in the season of 1864, when "Unremitting drought and clouds of grasshoppers swept the bloom of the fields and the verdure of the plains", which drove the settlers to seek subsistence elsewhere until another seed time.

Concerning the crop years of 1865 and 1866, Frank Trumbo said:

"We rented a farm about three miles from Vermillion, forty acres, which had been plowed the year before and as it had not rained during the summer of '65 there had been no weeds nor anything else grown on this land, so it looked

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<sup>4/</sup> Kingsbury, George W. History of Dakota Territory. Chicago, Ill., 1915. Vol. I, p. 289.

<sup>5/</sup> Robinson, Doane. History of South Dakota. Op.Cit. p.217.

like fresh plowing. I told my brother John that there was no need of plowing this ground but to furrow it out with the plow and I would drop the corn in the furrow and he could cover the seeds with the plow, so we did it in this way and planted the whole forty acres to corn. We waited all summer for our corn to come up, but it never made its appearance and upon investigation, about September first, we found the seed just as we had planted it, dry as a bone. It had not rained one drop during the summer of '66, there was no hay to be had on the Missouri bottom, where it grew in after years as high as six and seven feet, the saying that 'it never rains in Dakota', I think started that year". 6/

A conflicting report comes from Mr. Robinson, who wrote in 1904 that, "the yield of grain in 1865 was excellent, but the discouragement of the two previous years had prevented the farmers from putting out large fields." 7/ However in his later account he quoted from the address by Trumbo. 8/ If it had not rained during the summer of 1865, it is quite likely that the crops would not have been as good as his earlier volume indicates. It is evident that another severe drought came in 1866.

#### Some Grasshopper Years

In 1867 the rainfall apparently was adequate, for "Grasshoppers made another raid on the harvest and what had promised to be the best crop yet produced was very nearly destroyed in a day." 9/

The years 1868-75 were good, if the absence of specific comment on 1872 may be taken to mean that it was an "average" year. An exception was found around Vermillion at least, and is described in the same address by Frank Trumbo:

"After that, '67, '68, '69, we had rains and grass and what crops were planted grew fine, demonstrating that the soil was rich and would produce abundant crops of nearly all kinds of grain. But the grasshoppers came and they destroyed everything. People got discouraged and left the country and it looked as though we never would get a foothold." 10/

As Mr. Robinson did not observe these grasshopper plagues in his general history of the settlements, it will be assured that they were localized and not of general importance. But the reputation earned by the events

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6/ Trumbo, Frank. Address. South Dakota Historical Collection. Pierre, S. Dak., 1910. Vol. V., p. 85.

7/ Robinson, Doane. History of South Dakota. Op. Cit., p. 225.

8/ Robinson, Doane. South Dakota, Sui Generis. The American Historical Society, Inc., Chicago and New York, 1930. Vol. I, p. 395.

9/ Robinson, Doane. History of South Dakota. Op. Cit., p. 235.

10/ Trumbo, Frank. Address. Op. Cit., p. 87.



of the early 1860's persisted. The efforts of Congressman Ashley of Ohio to abolish the territorial standing of the whole area in 1869 brought out the belief that: "The country was worthless for agriculture, arid, and grasshopper-ridden". Further, "At Sioux City travelers were told that the great American desert lay just beyond the James River". 11/ A major disaster struck eastern Dakota in 1871 in the form of extensive prairie fires that raced over the plains in the fall of the year, leaving many families destitute in the settled areas. The fires, fed by heavy grass, crossed rivers, roads, and fire breaks without hesitation. That there was a crop in 1872 is attested by a statement in Kingsbury that over 2 million bushels of wheat were produced by Dakota territory that year, the product of the nine counties settled at that time. 12/

The grasshopper infestation of 1874 destroyed whatever crop there might have been, but there is the impression that a drought accompanied it. This was followed by another severe winter and by spring floods, and in 1875 the weather was favorable for crops. Trumbo reports that in his experience near Vermillion that year the grasshoppers came late in July and made the cleanest sweep they ever made. 13/ Mr. Robinson says, "In June grasshoppers passed over Dakota in immense swarms, which for days at a time darkened the sun, but fortunately they did not alight to do any damage to the farming section, and the crops of the year were superb, much the most extensive and prolific of any yet produced in Dakota". 14/ Thus the 'hoppers threatened on all sides but apparently the major part of the settled area escaped and enjoyed a good crop.

The year 1876 was a repetition of 1867, as "The crops promised splendid returns but grasshoppers came on July 25 destroying all unharvested crops". A severe winter followed, with an excellent harvest in 1877, to tide over 1878. In 1878 crops had given "splendid promise until the harvest was in progress, when they were struck with a blight which seriously injured the quality and reduced the yield." 15/

The year 1879 escaped mention by Mr. Robinson and others but had it been either exceptionally good or bad, it would not have missed all attention. Immigration proceeded at a high level, another indication that the crop situation was encouraging that year. The harvest of 1880 proved excellent.

#### Heavy Snow and Excellent Harvest

The winter of 1880-81 has become a proverb. Robinson says that as much as 11 feet of snow fell during the season. In the spring came the greatest floods the territory has ever known. Every lake and slough was filled to a high level. With a good season for crops, the harvest was excellent in 1881.

11/ Waldo, Elma La Moore. Dakota. Caldwell, Idaho, 1936. pp. 320 and 322.

12/ Kingsbury, George W.. History of Dakota Territory. Op. Cit., p.671.

13/ Trumbo, Frank. Address. Op.Cit., p. 89.

14/ Robinson, Doane. History of South Dakota. Op. Cit., p. 269.

15/ Ibid. p. 297.

Thus records of at least 20 seasons experience with South Dakota climate before the main tide of immigration and settlement reached Hand County in 1882 are available. In summary, there were 10 good years, 3 mediocre and 7 quite unfavorable. The adverse seasons came in two 5-year periods, the first in 1863 to 1867 inclusive, with a mediocre season in the midst; and the second came from 1874 to 1878 alternating with good years in 1875 and 1877. Of the bad seasons, two of them, 1863 and 1866, were only dry; two, 1864 and 1874, dry with grasshoppers; two, 1867 and 1876, with grasshopper invasions alone; and one, 1878, with a blight which in all likelihood was rust, since the high temperatures and many showers favored a severe rust infestation in Minnesota, northern Iowa, and Wisconsin that year, though the excessive heat was also a factor in crop damage. 16/ Outstanding was the period of 6 consecutive favorable years, 1868-73.

### Set for the Boom

By 1881 the stage was set for mass migration into the James River Valley and beyond, and the great Dakota Boom was on. The railroad had been built through the year before and the country to the east had been mostly settled. The philosophy of rapid development and private ownership of land offered every encouragement to enter and secure title to free lands. Tales of Dakota that bore the whole story of white man's experience, including the favorable and unfavorable, and freely exaggerated in both directions, were spread throughout the "States".

Many of the people who came were attracted from established homes and businesses, and all foresaw a reward either in a home, independence and stability or in a property title of some value. It seems most likely that departure for the "Territory" depended upon reports men had heard of the country. If very unfavorable, reports sent back to friends would not have brought many more settlers and settlement would have taken place slowly. The winter of 1880-81 may have had the greatest immediate effect on immigration. Though the disastrous floods in the spring discouraged some, the net result to those interested in agriculture was most encouraging. The melting snow filled sloughs and raised the water level, giving the impression of a country with high humidity. The favorable years of 1879 and 1880 immediately preceding it tended to dim memories of the troubles of earlier years.

Stimulated by another severe winter, in 1887 the press reminiscenced a little:

"The blizzard of 1880-81 filled all creeks, lake beds, and soaked the ground to the depth of several feet. The soil being very productive, this moisture was the one

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16/ Hamilton, Laura M. Stem Rust Destruction to Spring Wheat in 1878, mimeographed. Bureau of Entomology and Plant Quarantine, U.S.D.A. May, 1939.

element necessary to produce great crops that caused people to flock to this section and settle on farms. As is well known, since then there has been no such remarkable crops. In that first year, 1880, there was no settlement west of Huron, except one man and his family in the Wessington Hills in southeastern Hand. This man was Levi D. Haines, commonly known as 'horsethief Haines'. When the first settlers came here in 1881, and found water everywhere, this man Haines informed them they were 'd----d fools', because he had seen the prairies of Hand County burn like tinder in the month of June. They 'laughed him to scorn' but it has since occurred to many that he may have been thinking of our southern 'chinooks'. Not that we have seen such a condition prevail here, but it could easily be imagined when one of our gentle southern June Zephyrs begins operations in a very dry year." 17/

Briggs in discussing factors influencing the Dakota Boom refers to the preceding years:

"Although the irregularity in the amount and distribution of precipitation has been more or less a climatic handicap in Dakota, the rainfall during the boom period was ample and came at such times as to permit good crops. Had the period from 1879 to 1886 been as dry as the preceding eight years or the eight years that followed, there probably would have been no such rapid increase of settlement". 18/

Old-timers say that the sod at the time of settlement was very light but that is attributed wholly to repeated prairie fires, reputedly set by the Indians. A contributing factor might have been severe drought but a few years before, that killed part of the grass, or made it particularly vulnerable to destruction by fires.

These observations lead to the conclusion that the settlers were optimistic and wanted to see only the good side of the record. Were the surroundings not sufficient proof? They accepted the stories of promoters, for by the vagaries of climate these stories could be verified before their eyes in Hand County during those first years of settlement.

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- 17/ Miller Press, Miller, Hand County, South Dakota, Feb. 25, 1897. This newspaper was founded in 1882 in Miller and was known as the Hand County Press until November 9, 1893; the Pioneer Press from then until July 5, 1909; after which it became the Miller Press. The files of this paper will be used constantly as a reference in this report, and will be referred to hereafter as the "Press".
- 18/ Briggs, Harold E. The Great Dakota Boom, 1879-1886. N. Dak. Hist. Quart. 4 (2): 78, January 1930.



## HOMESTEAD BOOM (1882-1886)

Events of the first 2 years after the settlement boom reached Hand County supported the enthusiasm generated by the season of 1881. In the issue of July 26, 1882, the Press says, "Rainfall has been ample for all kinds of vegetation. Warm days and cool nights". The first few days of August were hot and on the 16th of the month the situation was stated thus in the Press: "Although we are not suffering, a good shower would be beneficial". Four days later rain came, so all crops including corn did not suffer lack of moisture that year. In 1883, by June 20 the county had been near disaster in the form of drought. Says the Press:

"Some anxiety has been occasioned by the dry spell of the last few days, and we are sorry to say that it became the leading topic of conversation to such an extent that a great many were getting discouraged. Our (The Press) exchange reports rains all over the territory at different times and places during the past two weeks. We cannot all have rain at once, or it is a very unusual thing at this time of the year. Besides the need of rain has not been felt yet, and the crops are now, and were, previous to the rains of Sunday, doing fine, and in almost as good condition as could be wished".

The same week it had rained, and another item appeared in the same issue: "The rain of the 17th was of uncalculable benefit to Hand County, not only so far as crops are concerned but the county as yet is to be rated as an agricultural county and the recent rains will make her rank first-class in good shape". On August 18, it is noted that in Miller there had been just 20 showers of rain since June 1.

In each of these years a situation was experienced that occurs regularly - a time came when rain was needed. It rained, and the crops were saved. Had it not rained so opportunely, there would have been failure. This has happened often since. It is interesting to note at this time that Hand County residents were not confident rain would follow. One senses in reading these items that nobody spoke of drought but that people were aware of the hazards and were "keeping their fingers crossed".

"We had a fine rain and you can't imagine how much better we farmers feel. Our faces are lots shorter than they were when the dust was flying so we could hardly see", reads a report in the Press on May 14, 1884, from Alpha Township. This season brought the first drought to Hand County after it was settled. It will be interesting to follow the reports from that one township through the season. June 5, "And still they come, a good shower every week, a prospect for a good crop never looked better in Dakota or elsewhere, than in Alpha Township." June 12, "Two fine rains on Friday and Saturday. Ground wet from 6-10 inches in depth. No more grumbling about hard breaking". This indicates no reserve, but getting along. On June 26, "Alpha - suffering for want of rain in some localities". On July 3 the season's progress was summarized "Eight days is the longest our vicinity has been without

rain since they started in the spring". On July 17 in Alpha "Fine crops are being harvested", and on July 31 wheat would average 15 bushels an acre and oats and flax were good. By August 14, it was "still dry" and the oats were ripening too fast. "Corn and late potatoes will soon suffer if rain don't come". On the 21st, "very dry, corn, sorghums, and late potatoes are suffering". It was still dry Sept. 11 - "Water is scarce - will be scarcest ever known if the weather allows it to freeze up without a high rain this fall". Thus the crop of 1884 was supported precariously by showers until the harvest was in sight, and then the showers quit coming. Not until early in October were there good soaking rains all over the county. The year 1885 started dry but considerable recovery was made and the result was a decided improvement over 1884.

#### Boom dies in 1886

Date lines are usually difficult to establish, but the Dakota Settlement Boom was definitely brought to a close by the adversities of the crop season of 1886. On June 10, the Press considered "Crops almost safe without more rain". By July 1, a report in the Press from Alden Township says, "Rain is rather scarce. The dust was intolerable a few days this week". During the ensuing week 110° in the shade was reached several times. Rains came August 5, too late to help the crops. The account of E. W. Smith emphasizes the intensity of the disaster: "In 1886 I drove 22 miles south of Miller, County Seat of Hand County, through a country that had been fully settled, and I passed only two inhabited houses and no crops of any kind". <sup>19/</sup> Hot winds are considered the factor directly responsible for the loss of the crop in this and succeeding years of failure. These winds had not been in evidence for a few years, and disappeared as completely again after several years of destruction.

#### EXPERIENCE AND ADJUSTMENT (1887-1901)

Judging from all accounts, it is obvious that many who came in 1882 and '83 on a wave of optimism, were willing to believe the worst they had ever heard of Dakota Territory as they left in 1886. The climate hazards of farming on the plains had become a part of experience. With this knowledge the period of reaction and adjustment of 1887-1901 began.

Heavy snow during the winter made a good beginning for the season of 1887. Rains came regularly throughout the summer, with no more than a hint of drought, and that short-lived. Favorable climatic conditions continued through the season of 1888, so much so that it was almost too wet to harvest throughout August. For the two seasons Dakota was an attractive place again. People having property and investments there returned, and a few others were attracted, principally for the 1889 crop

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<sup>19/</sup> Smith, Elbert W., Pioneering in Dakota. La Conner, Washington, 1929. p. 65.

year. The drought of that year can best be judged by reading some of the notes taken from the Press:

4/4/89 - A great prairie fire April 2, did immense damage in the southern part of the county, perhaps to the extent of \$100,000. Large part of Ree Heights destroyed.

4/18/89 - Sheepville reports a heavy shower on the 15th that did "considerable good in filling wells in this part of the county that had gone dry".

5/9/89 - Grand rainstorm on the 7th. This rainstorm was worth thousands to Dakota.

6/13/89 - The greater portion of Hand County north from Township 115 N. is not suffering for rain badly, but unless it comes in a few days it will become very dubious about first class crops. Good deal of complaint of dry weather comes from Township 115, north through Edmunds and Faulk Counties. Feeding old hay in Brown and Edmunds Counties.

6/20/89 - Some very fine rains in Hand County on the 18th. Immense rain on the 19th. Drought stricken portions of Brown, Spink, Faulk and Hand Counties visited with refreshing rains last week.

7/4/89 - Helmick - good rain on the evening of the 28th of June which did much good but some of the wheat, oats and barley are past redemption. Corn is booming. Spring Lake going dry.

7/11/89 - Saturday's hot wind was something the citizens of Hand County never experienced in this country before. It was a scorcher and if people were ever given a foretaste of the infernal region it was that day. A greater portion of the county was visited on the following day with big refreshing showers. ... Hand County people have never experienced a complete failure of crops. If you care to know what it is just talk to such old Nebraskaites as W. H. Sunderland and W. H. Waters. You will think you are in paradise yet. Farmers are advised to sow wheat on corn ground. This is not a one crop country. This year corn and flax will save their growers. Several wheat crops in Hand County will go 16 to 18 bushels.

7/25/89 - The late rains insure a hay crop. The worst report of this year's small grain will come in on the wheat crop.

8/8/89 - Charlie Dwyer predicts not over 5,000 bushels of wheat marketed from Howell Township this year.



Lucky to get his own seed back.

8/22/89 - Old settlers and Indians say every 9 years Dakota has an exceedingly wet year.

9/19/89 - "Grand old soaking rain on the 13th".

10/10/89 - Riverside - some farms short of stock water. Need rain before winter.

11/14/89 - Corn and oats shipped in for feed.

12/26/89 - Helmick - abundance of snow and farmers have quit making hay.

The great prairie fire recorded on April 2 is significant, revealing the extreme dryness in the spring of that year. It is reported that the relative humidity was the lowest recorded at Huron in many years. The wind was terrific and dust was blowing so badly that Miller residents were not aware that their neighboring town was in flames nor that the huge prairie fire passed but a few miles away. Each little rain that came throughout the summer brought quick-drying hope. The hot wind on July 7 cooked things, and from then on interest was focused on salvaging what little crop was left.

#### Hay Cut from Lake Beds in 1890

On July 3, 1890, to quote the Press, "The prospect for a bounteous crop is fine". The next week's issue reported a "Few moments of hot wind on the morning of the 5th but not enough to do any damage". On the 17th, the Press discussed the hot wind that came July 10th: "This year, as in others, a magnificent prospect was lessened one-fourth in the brief space of ten hours. Once again the hot south wind caught many wheat fields just at a delicate stage and the result is a repetition, to a certain extent, of history". The Press was preaching the lesson of diversification, to rely more on grass, feed crops, and livestock, to plan for adverse weather. The rest of the summer continued dry, but the short period of hot wind was the factor that really ruined the crop. That year was the first time the supposedly permanent lakes dried up completely, even Spring Lake, the largest of them all. Hay was cut from lake beds all over the county, where in some cases there had formerly been 6 to 10 feet of water.

The spring rains of 1891 started another crop on its way. "The faith of an average Dakotan is wonderful. As each spring opens up he will repeat, 'well, this begins to look like 1883'". The Press says this on April 9, and on the 23rd of the same month this item appears, "We do not recollect in the last eight years as favorable a spring as this, to crop". This year the optimism was rewarded with a good crop, well ahead of the two preceding years. The year 1892 was even better than 1891 as far as climate was concerned. Early in the spring, with a good year fresh in their memories and an abundance of moisture in the ground, the old enthusiasm returned.

"Never before since the settlement of the county has the ground been so thoroughly soaked as it is now, and never before since the disappearance of the boom spirit of 1883, have the people been so encouraged - felt so certain that prosperity in a greater or less degree is promised in the immediate future",

says the Press, reflecting the tenor of the street and farm. That the two good seasons did not again bring more people to Hand County may be attributed to low agricultural prices rather than to lack of optimism or enthusiasm concerning the climate.

A wet spring was all that saved the crop of 1893 during the period of hot dry south winds that came in the latter part of June. Crops had almost recovered from this when the Press reports, "Sunday, July 23, 1893, was a marker for weather in this section. The thermometers recorded all the way from 102 to 110. But as John Cowdry used to say of a 30 below zephyr, 'it was so light and dry we didn't feel it'". It was a year of near average rainfall, though dry during the month of August (fig. 2) 20/

Drought was even more intense through the season of 1894, although some few heavy rains in the spring brought short relief. The Press, optimistic, reports on June 14:

"His (R. D. Willett) average would be that crops are no worse right now than they have been at some time during nearly every season for several years, and in various seasons when the realization was far better than expected at some time or other during the growing season".

But this time the realization was far worse. There was no relief from the drought and the last 10 days of July were excessively hot, a condition that prevailed over all the western states. This was the driest season from the time these records begin, in 1893, until 1926.

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20/ Figure 2 portrays the data from table 1. In an effort to secure applicable information dating back as far as possible, precipitation records from weather stations surrounding Hand County were used. These are Faulkton, Huron, and Highmore beginning in 1893, Redfield and Gann Valley included since 1898, and Miller since 1902. That the stations included are increased at different times before 1902 will not detract materially from the continuity of the series. The table includes averages for each period of time significant to Hand County agriculture. The precipitation significant for the usual crop year was assumed to be that falling from September 1 to the next August 31. The growing season for small grains is assumed to be April through July, and for later crops such as flax, sorghum, and corn it is assumed to be April through August. This chart is particularly useful for years before 1902-03, when records from Miller become available. It should be studied in connection with the comments in the text for each year, and also period by period.

# PRECIPITATION IN THE HAND COUNTY AREA, SOUTH DAKOTA, 1893 TO DATE.

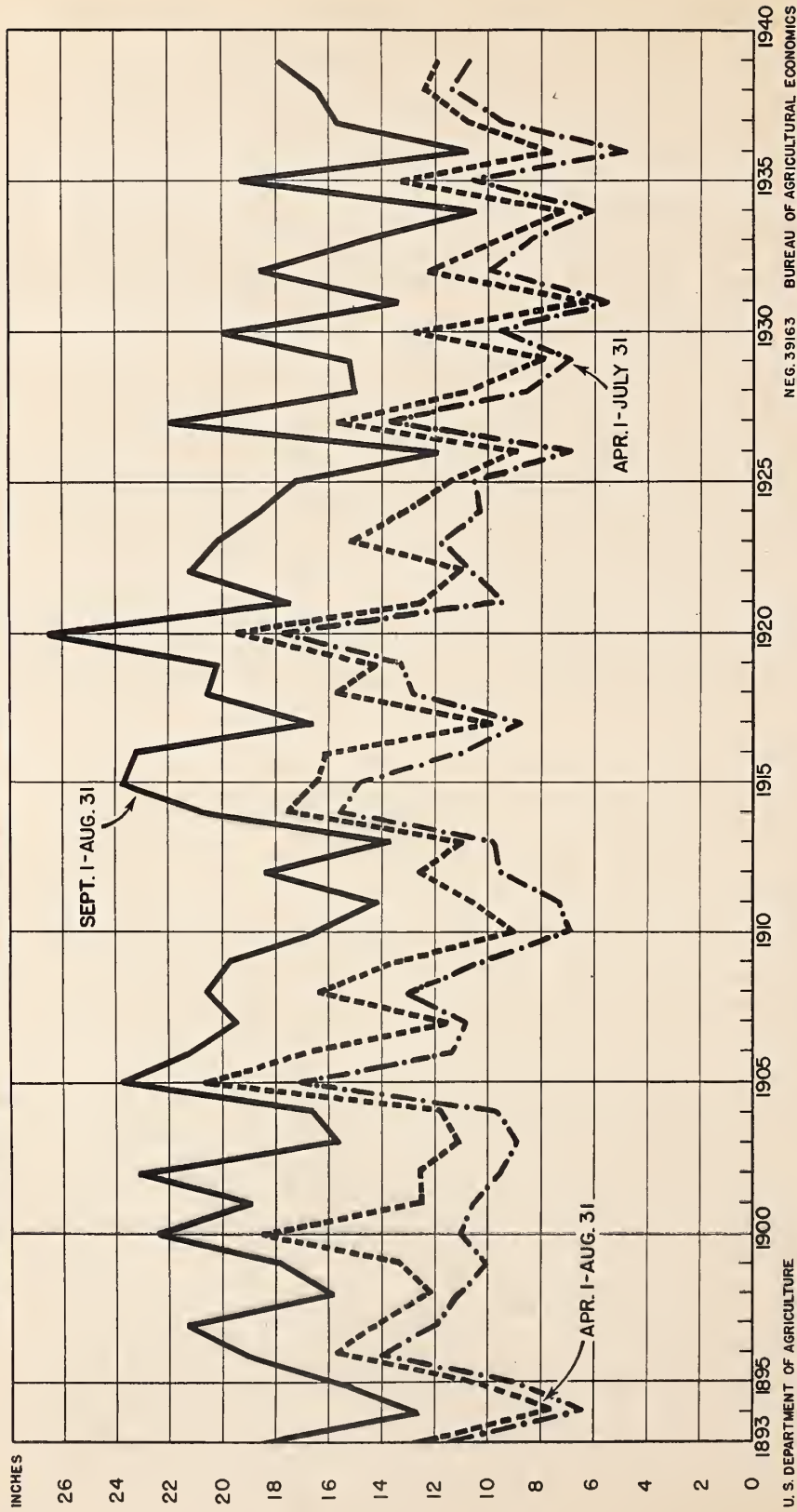


FIGURE 2 - CROP-YEAR PRECIPITATION VARIED IRREGULARLY FROM A HIGH OF 26.43 INCHES IN 1920 TO A LOW OF 10.45 INCHES IN 1934. SUCCESSIVE DRY YEARS AS 1894-95, 1910-13, 1925-26 AND 1931-38 ARE PARTICULARLY SIGNIFICANT. DISTRIBUTION OF GROWING-SEASON PRECIPITATION AND ITS PROPORTION OF THE CROP-YEAR TOTAL ARE OF IMPORTANCE IN THE PRODUCTION OF GRAIN AND FORAGE CROPS.

FIGURE 2



The season of 1895 was hot and dry, and its severity was intensified by the drought of the preceding season. The next season, 1896, moisture reserves were accumulated from heavy rains in the spring and early summer. Thus the damage was serious but not complete when the hot weather came for 2 weeks in mid-July. Late summer moisture was excellent for the corn and late grains.

The winter of 1896-97, the "winter of the big snow", was comparable apparently to the winters of 1861-62 and 1880-81. Farmers who lived in the rolling area south and west of Miller, in Glendale Township for example, say that the country appeared to be level before the snow melted. The pot-holes and draws contained drifts to a level with the ridges and travel was practically impossible. The lakes and sloughs, which had been dry for several years, were filled again when the snow melted and the ground was thoroughly soaked. This is one of 11 out of the 47 years recorded when the Hand County Area had over 7 inches of winter precipitation. Drought and frost in May and hot weather in July prevented a good crop in 1897 although precipitation was above the average both in winter and in the growing season.

#### Crop Prospects Change Quickly

The crop season of 1898 was a repetition of many others. On June 30, the Press says, "The elegant prospects of early June for a bumper wheat crop are materially changed at the latter part of the month. Wind and hot weather and no rain have been getting in their work. It is idle waste of time to predict crop results, as conditions change so rapidly". Precipitation for the year was below average except in the early part of the growing season. The next year started off as well or even better, and while the crop was larger, it received a severe set-back in both quantity and quality during the last few days of July.

In 1900 the Press seemed to feel that the optimistic forecasts of crops had been overdone, April 12: "Seeding is progressing rapidly now, with ground in fine condition. But when was there a season without a fine prospect at the beginning or sometime before harvest?" By May 31, "Rain is needed from South Dakota to Ohio". The thermometer was passing the 100° mark before the end of June and apparently continued hot and dry until August. Ample August rain brought a good crop of corn, hay and potatoes. Nature was generous in the early part of 1901, and again "reports are the finest we have had for years", says the Press July 1. But on the 13th of the month, "For seven days last week the thermometer registered 104° and over. This is the longest heated spell that this section has ever experienced and surpasses all records even at points far south of here". Drought continued until near the end of the month. Had not a good reserve of moisture accumulated earlier and conditions been very favorable up to that time, total failure would have been in order. As it was, there was tremendous straw growth with small tip-burnt heads, and only a fair crop of small grains.

### Nineties not so Gay

The period of reaction and adjustment lasted from 1887 through 1901, a period of 15 years. The first two seasons were favorable, and revived the faith of many who were ready to give up after the boom had been blighted by drought. Seven of the next 13 seasons were adverse, and 1889 was much the worst. Only two, 1891 and 1892 could be said to be really good, although 1899 was very nearly in that category. The latter was especially significant because it was preceded by 3 years that were fair, with each an improvement over the one before.

Throughout the period, moisture was prominent as a limiting factor in crop production, a strong force in adjusting to an extensive type of agriculture. The good years had not occurred singly but in pairs and two in succession were enough to revive the hopes of many. Likewise the 4 fair years, 1896-99, put the area in a favorable light, leading up to the second boom period beginning in 1902. Apparently diversified farming avoided the set-back one might have expected agriculture to have suffered as a result of the drought of 1900, and the same factor made 1901 seem relatively better than it actually was. Average precipitation for the last 9 years of the period was very close to the average for 47 years.

### THE GOOD OLD DAYS (1902-20)

At the beginning of the next period, January 1, 1902, a Cooperative Weather Observer began making regular observations for the U. S. Weather Bureau in Hand County. 21/ The important records are daily temperature readings and precipitation. Some notes on hail storms, hot winds, dust storms, and frosts are so incomplete as to be of little value. Wind directions and velocities are available only for the Huron Station, 40 miles from Miller as the crow flies. From 1902 to the end of the period covered by this study, official records will be relied upon to describe the progress of the seasons and will be supplemented by material from the Press, and by occasional comments of farmers. Figure 5 portrays the daily maximum temperatures and precipitation for the growing season months, April-August, for 38 years, 1902-39. The average maximum temperature for each day for the entire period is shown in the first chart. Also included is another series of points, each one a standard deviation above the average for that day. 22/ The curves described by these points were smoothed to eliminate chance variations, and the smoothed curves were transferred to the annual charts for purposes of comparison. The upper curve should set off about one sixth of all observations and these will arbitrarily be called the hot days.

Figure 4 summarizes some of the data of figure 3, and includes information on hot winds. The first chart shows the total number of days

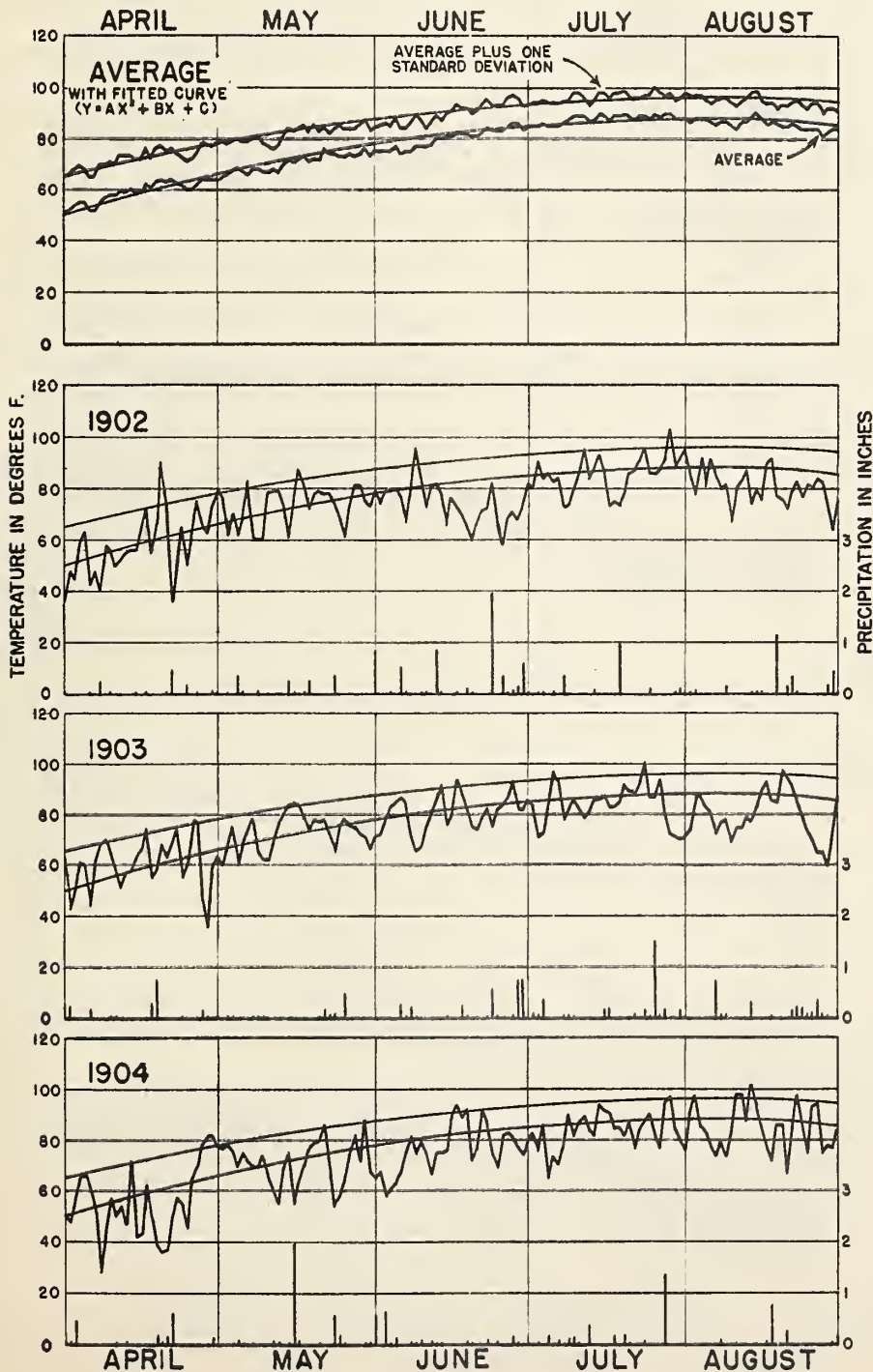
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21/ The station was at Howell Post Office, 17 miles north of Miller from January 1, 1902 to June 30, 1921; about 7 miles further south near the center of Florence Township; July 1, 1921 to December 31, 1921; and in Miller since January 1, 1922. Changes in location will not be taken into account in using the records.

22/ The standard deviation is the square root of the arithmetic mean of the square of all deviations, deviations being measured from the arithmetic mean. It is used here merely as a convenient statistical device to designate the extreme maximum temperatures.

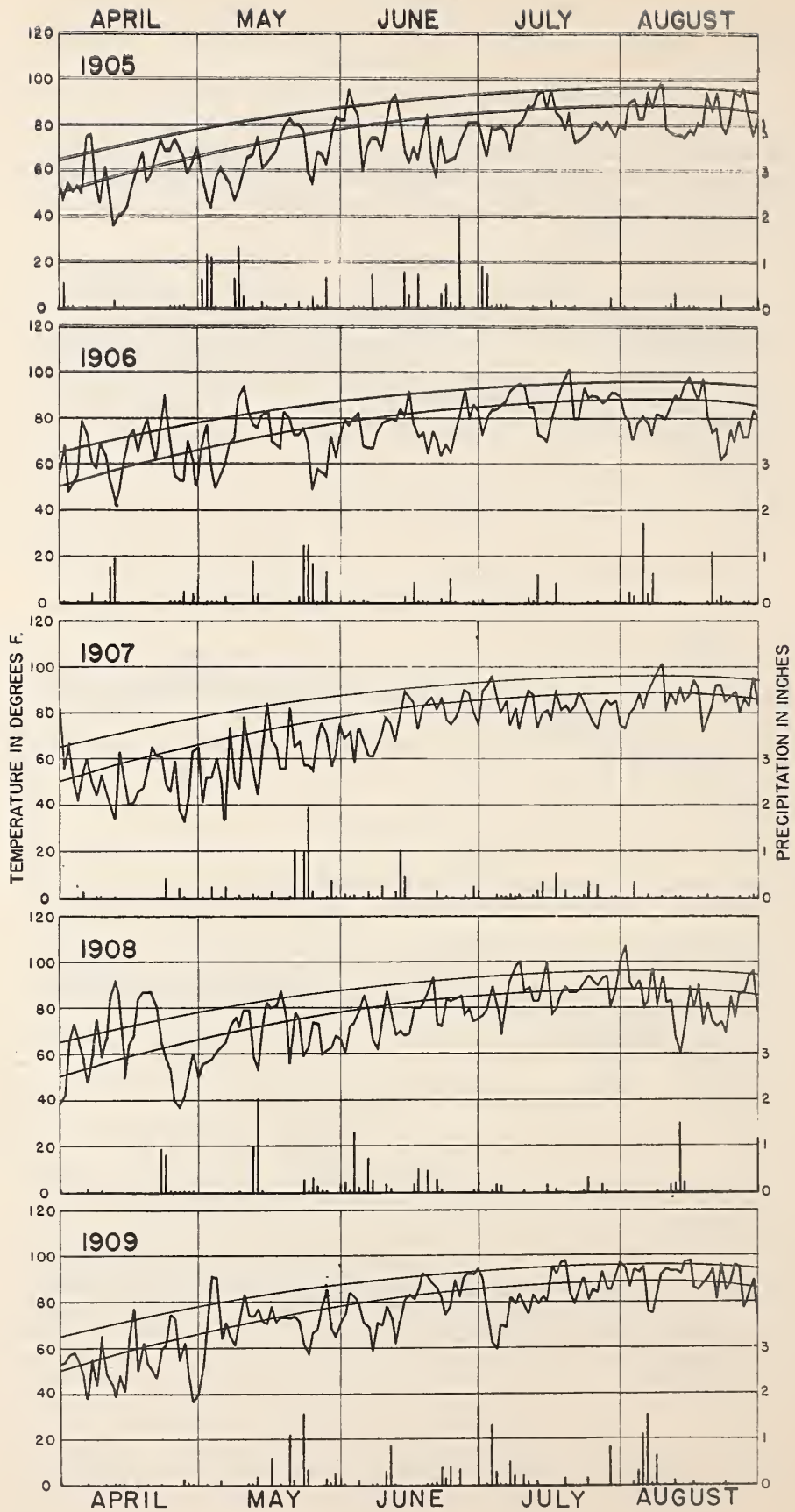
FIGURE 3.-DAILY MAXIMUM TEMPERATURES AND PRECIPITATION, APRIL 1-AUGUST 31, HAND COUNTY, SOUTH DAKOTA, 1902-1939.

THE DAILY MAXIMUM TEMPERATURES FOR DIFFERENT SEASONS ARE COMPARED WITH THE DAILY AVERAGE. A LINE IS SHOWN ONE STANDARD DEVIATION ABOVE THE AVERAGE, AND POINTS FALLING ABOVE THIS LINE INDICATE "HOT" DAYS. THESE WERE PARTICULARLY FREQUENT IN 1910, 1911, 1913, 1921, 1925, 1926, AND 1929-1936. NOTE THAT THE VERTICAL BARS SHOWING PRECIPITATION ARE ASSOCIATED WITH COOLER WEATHER.

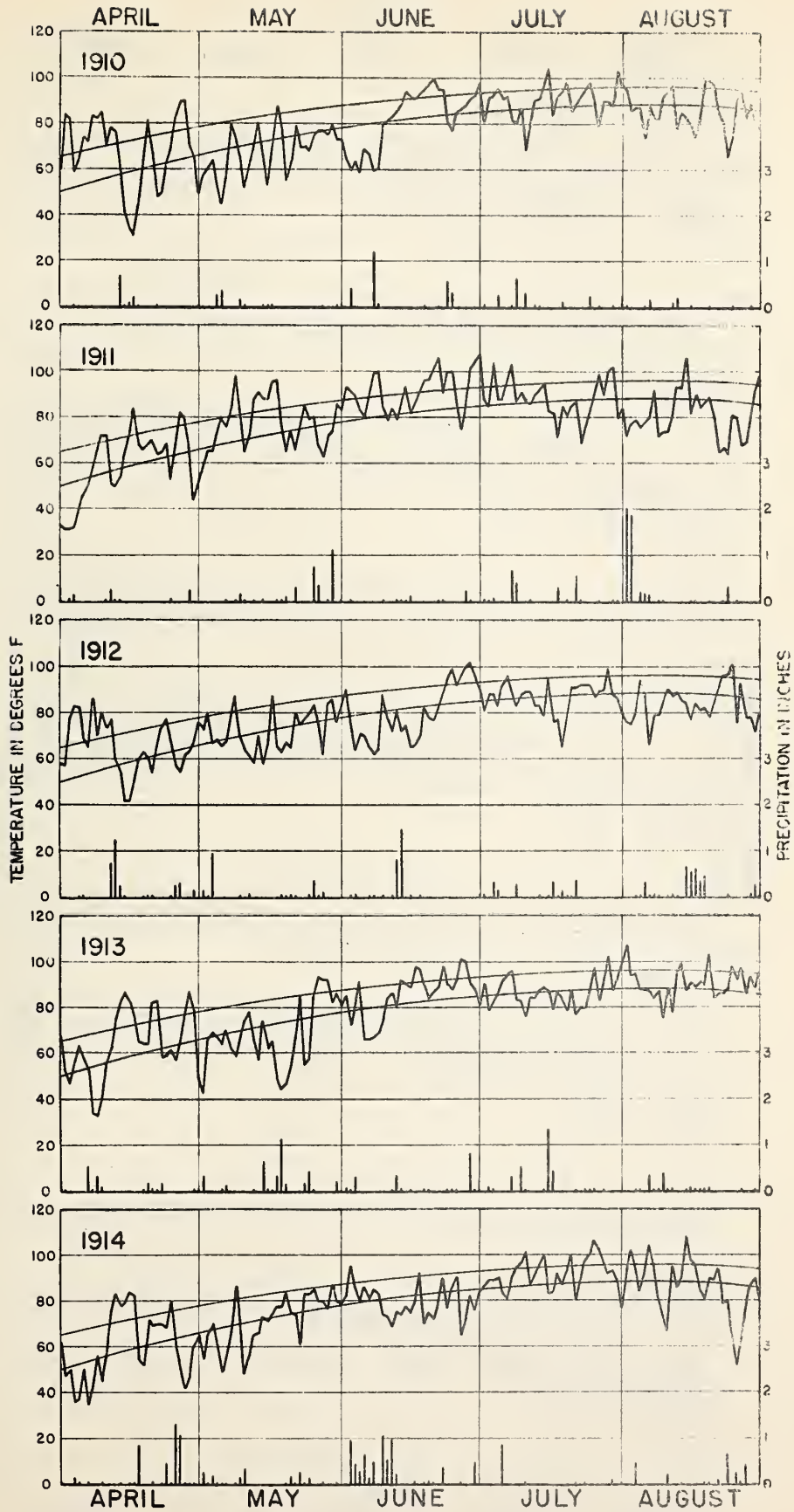




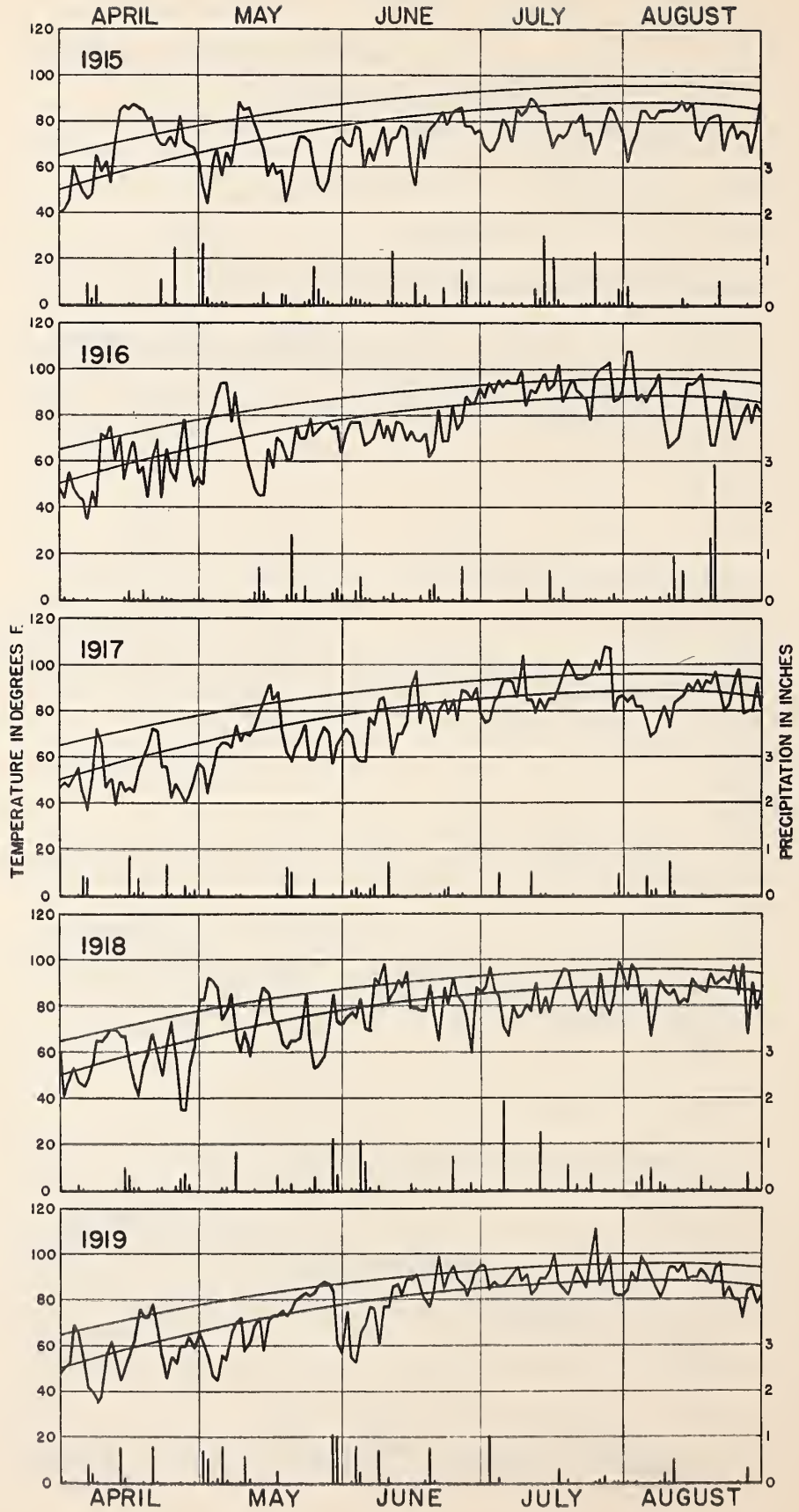
## PLATE 2



## PLATE 3

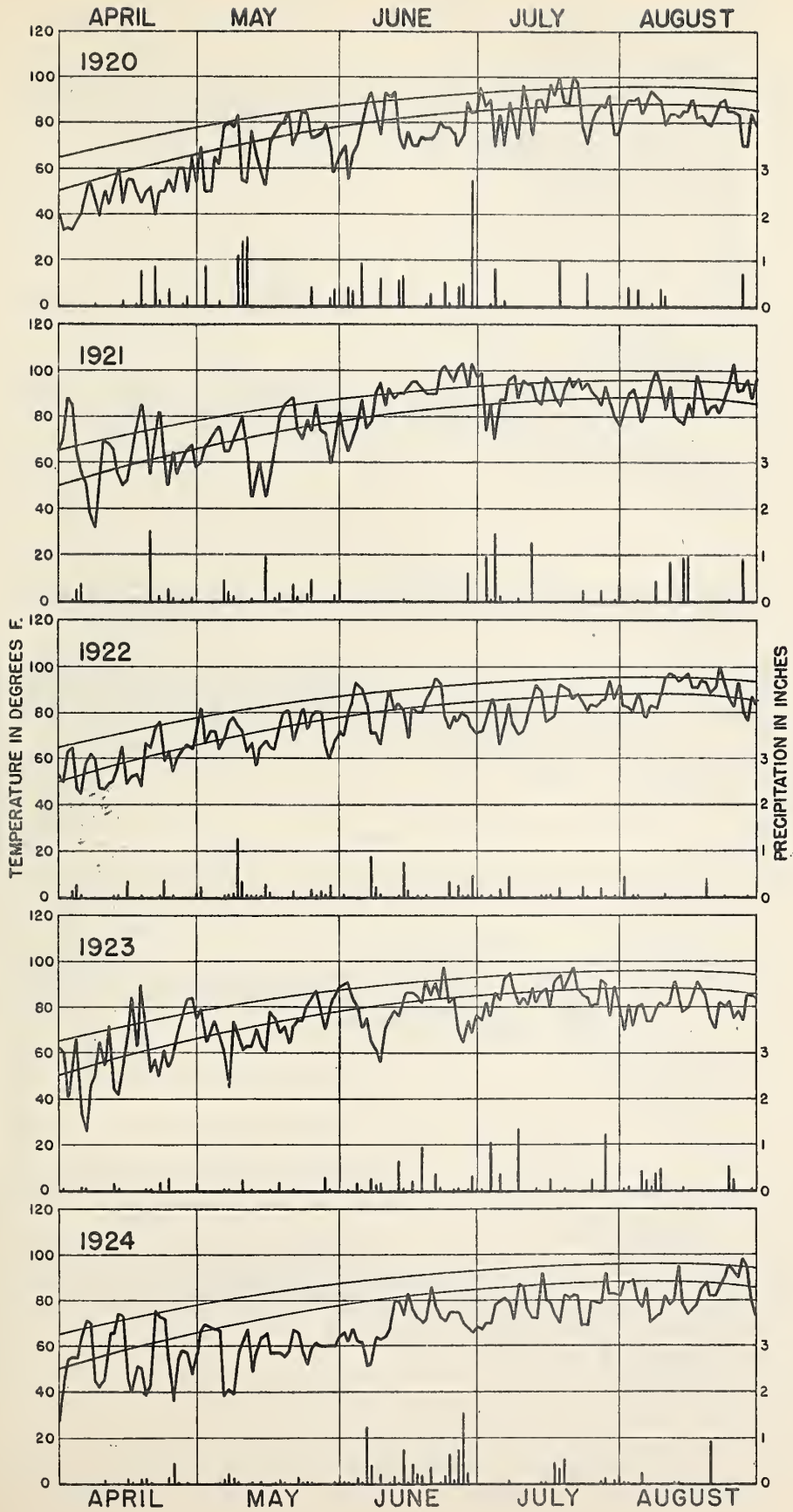


## PLATE 4

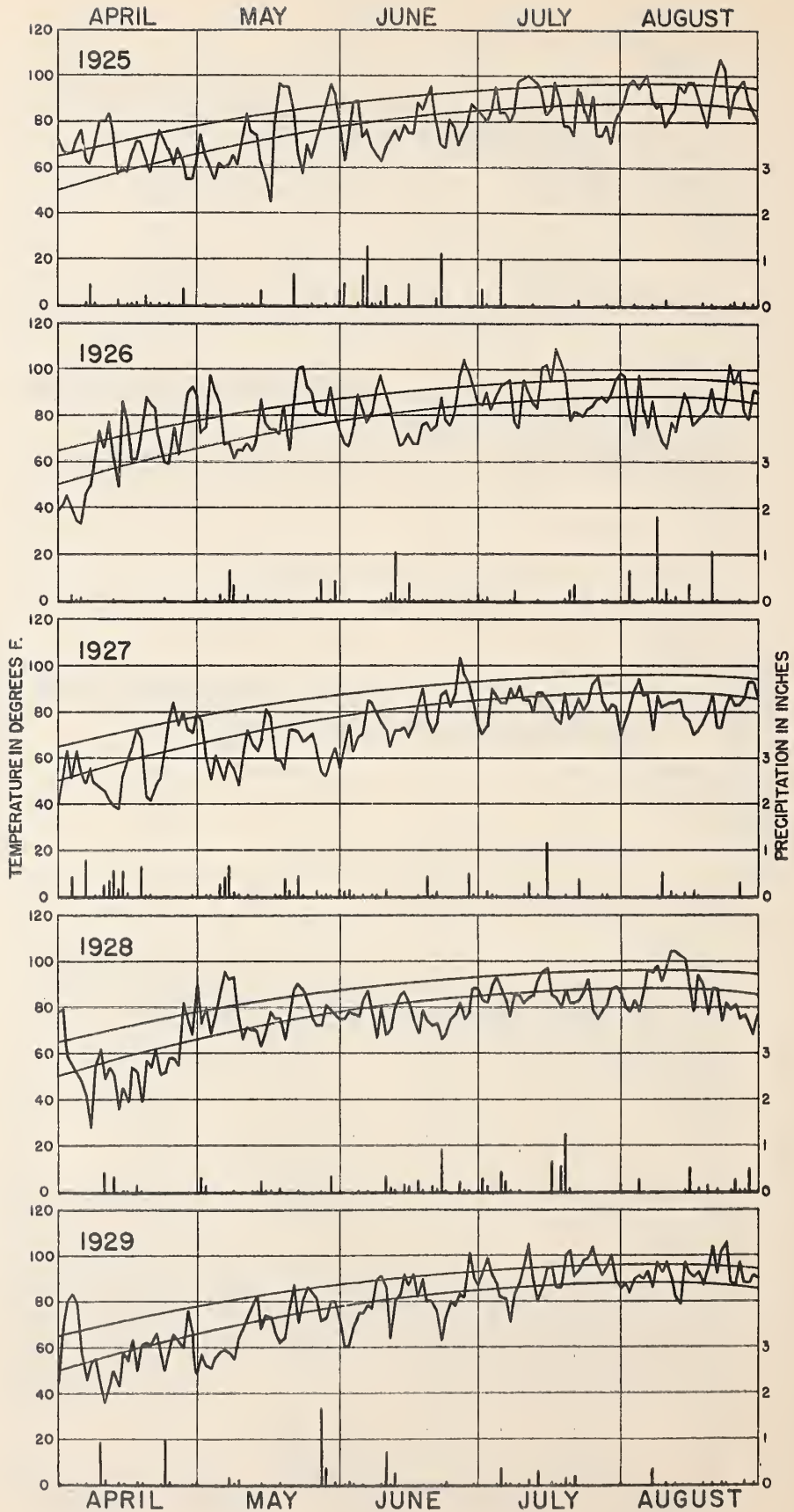




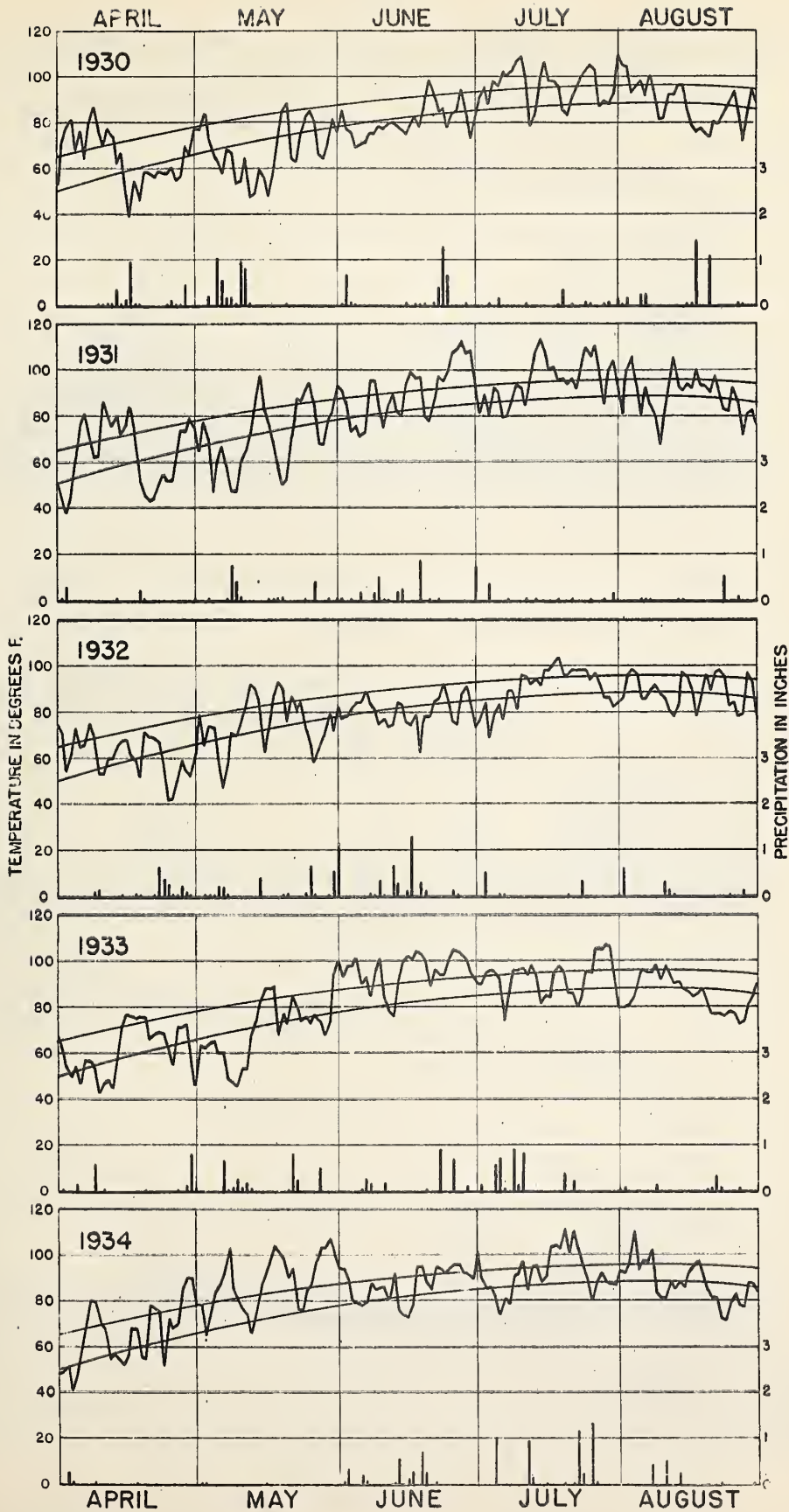
## PLATE 5



## PLATE 6

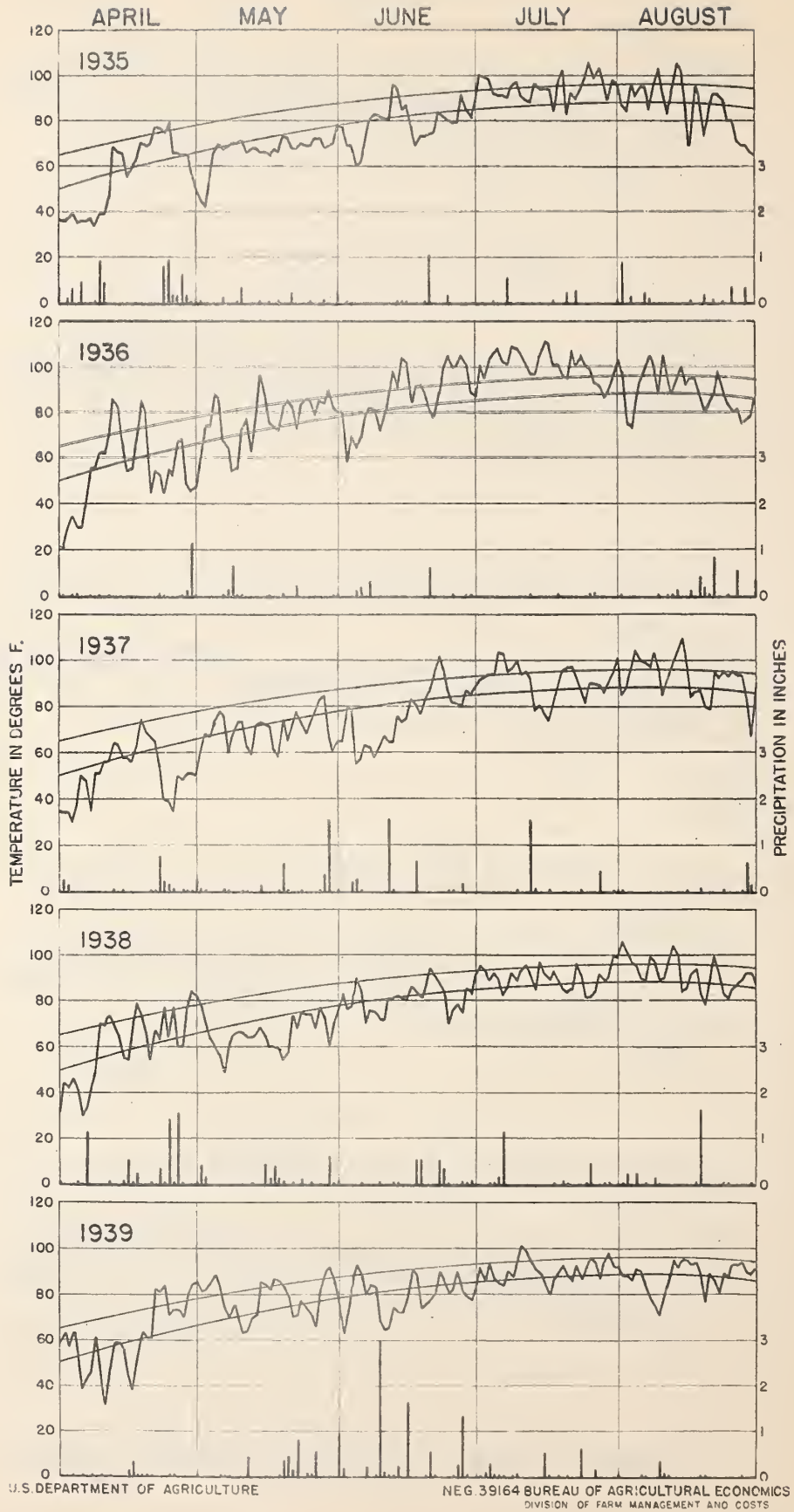


## PLATE 7





## PLATE 8



# DAYS IN DROUGHTS, HOT DAYS, AND HOT WINDY DAYS, APRIL - AUGUST, HAND COUNTY, SOUTH DAKOTA, 1902 - 39

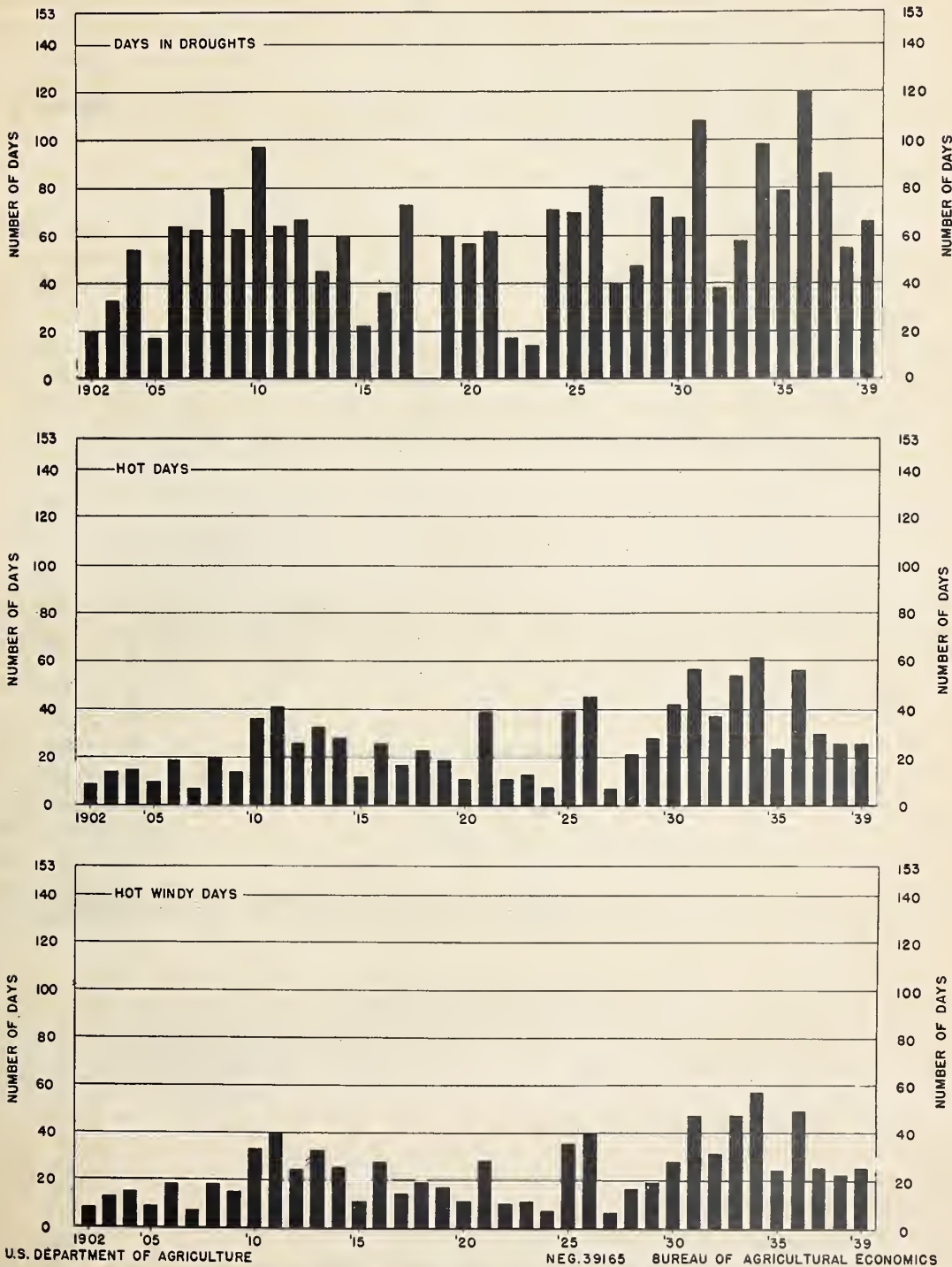


FIGURE 4.-THERE IS A CONCENTRATION OF DAYS IN DROUGHTS (PERIODS OF TEN DAYS OR MORE WITHOUT SIGNIFICANT PRECIPITATION), HOT DAYS, AND HOT WINDY DAYS IN 1906-14 AND 1929-37. EXTREMES OF ALL THREE CONDITIONS TEND TO OCCUR TOGETHER, NOTABLY IN THE YEARS 1910, '11, '21, '25, '26, '30, '33, '34, AND '36. THE EFFECT OF DROUGHTS IS LESS SEVERE WHEN NOT ACCOMPANIED BY HOT DAYS AND WINDS, AS IN THE YEARS 1904, '06, '07, '08, '09, '17, '20, AND '24.

FIGURE 4

involved in periods of 10 days or more without significant precipitation at the Hand County Cooperative Observer's Station during the summer season. The second chart summarizes the total number of hot days during the same months. The third chart shows the number of hot days in Hand County when there was a southerly wind of over 10 miles per hour recorded at Huron. Figure 5 shows in detail the summer droughts summarized in the first chart in figure 4. Considerable judgment was used in determining when rainfall was significant, depending upon length of time involved, and amount of rainfall before and after the period.

Almost  $10\frac{1}{2}$  inches of winter precipitation gave the season of 1902 a strong start. The growing season followed with the characteristics that are very favorable to crop production. These are well distributed rainfall, with few and short dry spells, and very few hot days. This may be seen in figures 3-5. Though considerably below average in rainfall, the season of 1903 was sufficiently favorable to produce a better than medium crop. This was because the preceding season had been wet, and also because the dry weather did not bring with it the excessive heat and scorching winds of a few years before.

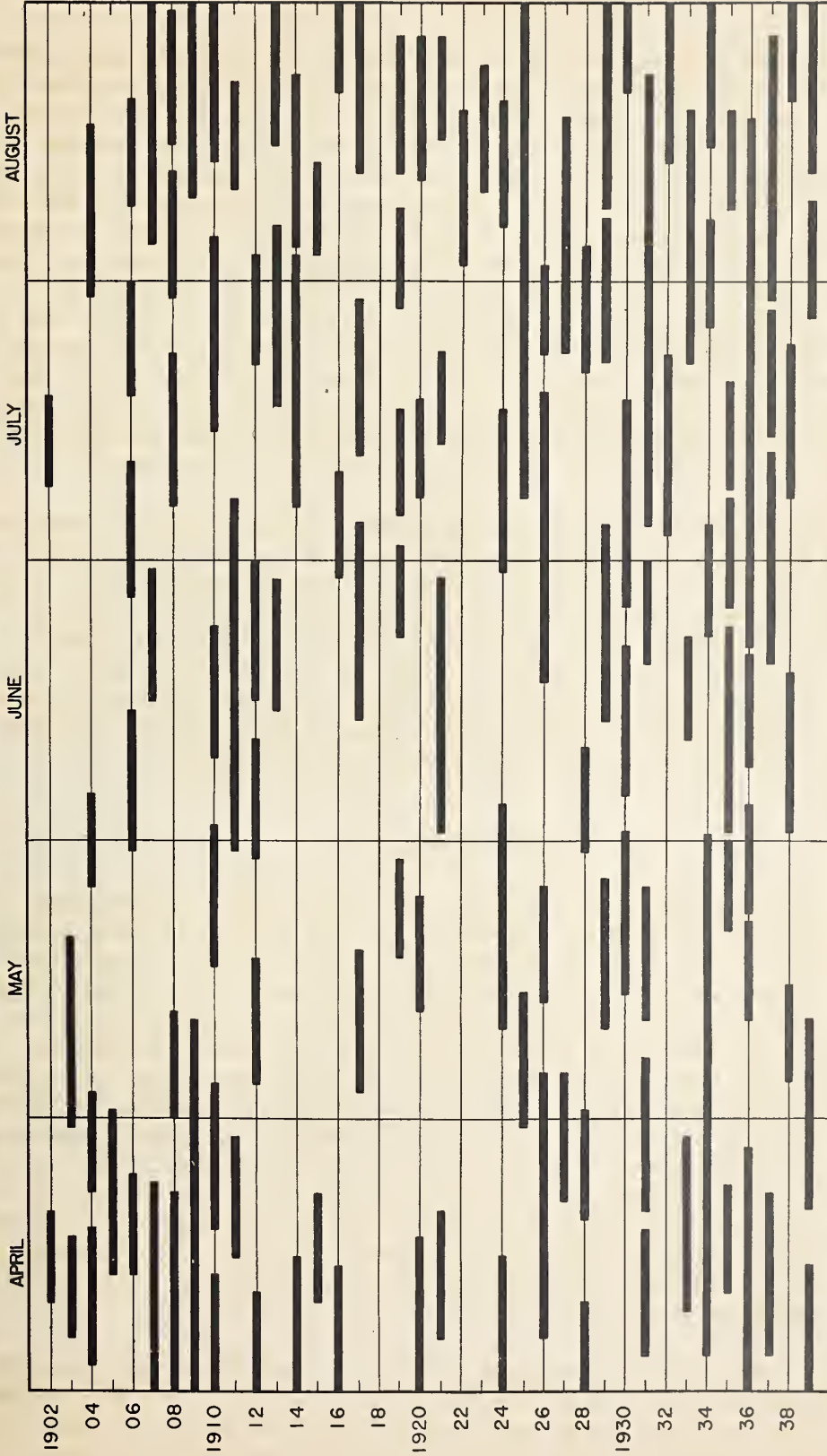
#### A Fair Decade

Still below average in rainfall, the season of 1904 was adequate for a fair crop, largely because the rains came at opportune times. Showers were scattered with some sections favored more than that around the weather station. This raised the average. The wheat crop suffered considerable rust damage in 1904. Through the winter season prospects for a crop in 1905 were not favorable because of drought, but unusual late-spring and summer rains brought the best all-around crop in several years. Not until 1910 was precipitation below average, and with the exception of a dry August in 1907 and an early spring drought in 1909, moisture conditions were good. There had been no serious hot weather since 1902. After a winter of good precipitation, 1910 turned dry with only small rains interspersed between droughts, and hot days were frequent. The condition lasted until almost the end of July in 1911 when heavy rains came early enough to save the corn crop. The Press placed the blame for failure in 1911 on the "unusually" hot weather rather than drought, while looking back over the record it appears both factors were important.

Winter moisture and generally cool weather provided a fair crop in 1912, although a few hot days in the latter part of June were very damaging. The 1913 crop suffered from the lack of moisture throughout both the preceding winter season and the growing season, although there were no prolonged droughts in the growing season until the latter part of June. A few hot days occurred at that time and the Press, June 26, 1913 says, "The early favorable conditions of May have not been maintained through June, owing to dry, windy weather".



# SUMMER DROUGHTS, HAND COUNTY, SOUTH DAKOTA, 1902-1939



U.S. DEPARTMENT OF AGRICULTURE

NEG. 39166 BUREAU OF AGRICULTURAL ECONOMICS

FIGURE 5 - EACH BAR REPRESENTS A PERIOD OF TEN DAYS OR MORE WITHOUT SIGNIFICANT PRECIPITATION. WHILE DROUGHTS OCCURRED FREQUENTLY THROUGHOUT THE ENTIRE PERIOD, THEY WERE ESPECIALLY NUMEROUS AFTER 1925.

FIGURE 5

### Most Favorable in History

In 1914 began a series of wet years, the most favorable for crop production in the history of Hand County. Of the seven seasons 1914-20, the only one not well above average rainfall, both for the entire crop year and for the growing season as well, was 1917. The seasons of 1914 and 1917, however, produced only fair crops, the former falling down because of poorly distributed rainfall and hot, dry weather that came about July 8, bringing with it a rust infestation damaging to wheat. Reserves of moisture, well distributed rains and cool weather boosted the 1917 crop above the level that might have been expected from the precipitation received. The most severe rust year on record was 1916 when it is estimated that South Dakota lost 37 percent of her wheat crop, and Hand County seems to have been no exception. There was localized damage in 1919 and 1920. The summer of 1918 is the only one of the 38 years recorded which had no drought, it was one season when the farmers weren't hoping for rain at one time or another.

Considering the period 1902-20 as a whole, average precipitation was well over the long-time average, in fact it was in many ways the "good old days" of Hand County history. Summer droughts were infrequent and of short duration and there were comparatively few hot days. Two seasons can be ranked as "excellent" and eight others as "good", accounting for 10 of the 19 years. Eight of the remainder were good enough to yield fair crops, and only one, 1911, approached failure. This far surpasses any other period known in the climatic history of this area and had a profound influence on agriculture.

### DECLINE (1921-29)

Factors other than climate brought the first indications of distress in Hand County agriculture, but the season of 1921 appeared to introduce a new phase in climate, one of decreasing precipitation, and the return of hot winds. Although that year was not far below average in precipitation, the hot dry weather in June reduced the small grain crop to even less than fair. The 3 years following, 1922, 1923, and 1924 were all above average in total precipitation, with crops thriving accordingly. With the exception of severe wheat rust, the year 1923 was the best since 1918. Peculiar circumstances - a combination of ample winter moisture and a cool summer saved the 1922 crop when growing season precipitation fell short. A glance at figure 3 will show that the maximum temperatures of that year were the most even of the 38 years. 1922 and 1923 each had only one dry spell and these were not severe. Dry spells came more often in 1924, but the weather remained cool.

On July 9, 1925 the Press felt that Hand County was assured of a fair wheat yield. A week later, however, extreme hot weather had reduced the crop to a level materially below the July 9 prediction. From that date until August, 1926, there was very little precipitation and much hot weather, with almost complete crop failure in 1926.

Weather conditions in 1927 were unusually favorable, bringing excellent crops of every kind, despite rust in wheat. By early May, 1928, high winds, accompanied by very dry weather, had been blowing the soil. The small grain crop was light, and hot winds lasting for more than a week in early August severely damaged what had promised to be an excellent corn crop. Growing season precipitation was very light in 1929, and the result was another poor year.

These 9 years which make up the "post war period", or "period of mechanization" brought four good-to-excellent, two fair, and three poor seasons. In general, annual precipitation declined and droughts became more frequent during that time. Moisture reserves accumulated during the previous years were gone by the end of 1926, and were not replaced by the end of the period. Alfalfa is reported to have begun dying out in 1926 and conditions have been unfavorable for it since.

#### DROUGHT AND DEPRESSION (1930-39)

The period of drought and depression began in 1930 under circumstances already unfavorable for crop production. 1930 brought only a medium crop of small grain and corn, although the growing season was above average in rainfall. The following season had long droughts with much heat and wind; it resulted in almost total crop failure. Hopes for a good crop in 1932 were encouraged by a very favorable season for small grains. In July, a dry spell with winds and high temperatures ruined the corn crop. Still, it was much better than the three previous seasons. With crop year precipitation  $3\frac{1}{2}$  inches below average, 1933 brought a very poor crop. Most damaging was the excessive heat in June, although the drought period in that month was of short duration.

"The most violent dust storm in history swept over this section on the 12th, continuing unabated for more than ten hours", reports the Press on November 16, 1933. Thus began the driest season experienced in the area. Dust storms occurred repeatedly during the winter. Early in 1934 the Press was looking for "enough moisture to lay the dust" whenever it snowed or rained. Again in the Press, "Tuesday, May 8, will go down on record as the hottest May day in the history of the state. The weather man certainly felt in a disagreeable mood this week, setting up new heat records for May, and then turning loose a dust storm which equalled the historic one of November 21, 1933". The maximum temperature on May 8 was 103°. This was twice equalled and twice exceeded later in the month, 107° being the May record at Miller, established on May 30, 1934. The average of the daily maximum temperatures for May of that year was 87°, while for the 38 years since 1902 it is 70°, and 1934 was the only year in which the average was over 79°. The heat and drought of April and May, following a dry, dusty winter, brought crop failure over a tremendous area in the Plains and Prairie States. The five months of the growing season had 62 hot days, a third of them coming in May. Hot winds intensified the damage. Of the 153 days in these months, 97 days were included in droughts, the longest covering almost 2 months in April and May.



### Hot Days, Hot Winds, Drought

The season of 1935 was an improvement although wheat yields were reported in the Press to have varied from fair to poor because of rust. Forage crops were favored that season. The 1936 drought brought a failure almost as complete as in 1934. Marked differences in the character of the two seasons were noted however. The 1936 season followed a particularly cold winter, as dry as the winter 2 years before. The spring was dry but relatively cool, with substantial rains around the first of May. The real damage did not begin until June 22, and from then until August 19, the county had no significant rainfall. This season had 56 "hot" days, almost one-half of them in July, with many hot winds. Droughts involved 120 of the 153 days in the summer season. Although in some respects the 1936 drought was more severe than the one in 1934, it was not considered as serious, because livestock numbers had been reduced, further adjustment to resistant crops had been made, and its arrival late in the season gave crops a chance to start. But the disaster of two practically complete failures with little respite in the year between cannot be overemphasized.

The three following seasons were progressively better, with 1939 the first after 1935 to approach average precipitation. The 1937 crop was poor in yield and quality, having made a rank early growth that could not stand hot weather later. The next year the quality was much improved and the crop "fair to good" as reported by the Press. In 1939 the crops were the best in several years, though injured some by hot dry weather in May.

These 10 seasons set a record in the 78 surveyed. Two were so adverse as to bring total crop failure, 3 others were almost as bad, and 4 brought only light crops. Only the last, 1939, could in any way be described as a good crop season.

### WINTER AND FROSTS

The character of the winter season is important beyond the precipitation it brings. Long, severe winters make heavy demands on feed, and, if they come early, interfere with important farming operations such as stacking native hay and picking corn.

The winter seasons from 1881-82 to 1901-02, the first twenty-one years of Hand County Settlement can be estimated fairly well from the Press. This record should dispel the legend that severe winters are the rule in Dakota, for in 14 of these seasons winters were more or less open. Open winters, that is, winters with limited snowbound periods, were sometimes very dry. Others were open through the early and midwinter months, from November until February or March. It may be said of the winter seasons that they vary from extremely cold and snowbound to warm and open, though at least one period when subzero temperatures are reached is quite certain every winter.

Late spring frosts are hazards to small grains, flax, and corn, and early frosts in the fall often damage immature corn and, more rarely, wheat. The Press often speaks of a corn crop made if the frost holds off a few days. May 10 has been the average date of the last frost in the spring and September 26 the average date of the first frost in the fall, giving an average number of 139 frost free days (table 12). Frosts have been mentioned in the Press as late as June 19, and as early as August 22. Damaging frosts usually occur between May 15 and September 10, though early or late seasons bring considerable variation in the time when crops are susceptible to frost damage.

In the past, frosts have been more damaging in some parts of the country than in others. Farmers living on the slopes of the Wessington or Ree Hills which have air drainage have often escaped frosts that have done considerable damage where the land is level.

### HAIL

The best account of hailstorms for Hand County is that chronological record, the Press. Ninety-three hailstorms are mentioned over a period of 53 years, damage being from negligible to very severe and extensive. Many of these storms were small and caused little or no damage, but at least 60 of them were significant. Of these 60 storms, 39 were judged on the basis of the information in the Press to be moderate because of localization or relatively light damage over a wider area. Sixteen appeared to be severe, involving several townships and causing a high percentage of crop loss. Five storms were of outstanding extent and severity.

Almost the entire county has suffered hail damage at some time or other. A map of the storms shows a concentration of them across the northern part of the county, and in an area around Miller. The latter may be a result of bias associated with the location of the Press office, but it seems clear that the level, intensively farmed part of the county is more subject to hail than are the rougher portions.

### DUST

"Our faces are lots shorter than they were when the dust was flying so we could hardly see". On May 14, 1864 is found the first reference in the Press to dust storms in Hand County, only 2 years after settlement was well started. The following spring dust was bad for a few days. By July 1, 1866, "The dust was intolerable a few days this week". A like situation prevailed on April 2, 1889 when the dust blew so badly that Miller residents were not aware of the great prairie fire of that date.

These examples, appearing frequently in the record of the early years, are cited to point out that the experience of November 12, 1933 was not entirely new. The difference was that on the later date the soil moved more freely. Serious wind erosion occurred after the soil

had been disturbed by years of cultivation, and the grass roots and accumulation of plant fibers and humus in the soil had been depleted. It is a further warning that more storms may be expected - perhaps no more frequently, or no less frequently, but certainly without warning.

## WATER CONSERVATION

Water conservation and water utilization figure prominently in present agricultural planning and action programs in the semiarid and subhumid areas of the Plains. Hand County residents became aware quite early of the need for development of supplemental and stable water supplies. The first warning came in 1884, when water shortage was imminent after a dry summer. Again in 1889 some parts of the county were short of stock water.

Attention turned first to the great artesian water basin underlying Eastern South Dakota, a supply that appeared inexhaustible. In 1889 the Press was booming artesian irrigation, which had been the subject of some experiments north of Huron during the year. During the first few years of their use, however, artesian wells were so expensive that they were public rather than private projects. The cost of a well at first was \$2,000 to \$3,000. Legal machinery was set up in the form of the Melville Township Law to permit boring public wells, 9 to 16 to a township. Wells were to be located by the State engineer, and water was to be let by township officers for irrigation. The development of efficient machinery brought the cost down to \$600 to \$1,000 where it permitted individual investment.

The Press in January 1891 expressed a desire to see "A herd of cattle on every hill, and an artesian well in every valley". It also considered runoff control when it urged the damming of all feasible coulees and pumping to fields as a supplement to artesian water and rain.

The use of artesian water for irrigation was a short-lived hope. The history of that huge supply of water is well known. It was first found with heavy pressure. The first well at Miller discharged 20 feet or so into the air. A well in Woonsocket, S. Dak. for many years supplied power to a mill. It was a common occurrence for these wells to flow unrestricted. Thousands of them gradually exhausted the supply until now many wells either have ceased to flow entirely, or have only a scant flow. Those that do not flow are pumped as needed for stock and household supplies from various depths.

The location of water supplies was important in the settlement, and subsequent development of agriculture, in Hand County. During the first years, water was found readily almost anywhere, if not in streams and sloughs, in shallow wells. In 1884 certain parts of the county, notably Riverside, Campbell, Greenleaf, and Alden Townships



developed water shortages. Frequently farmers filed on land in those townships only to relinquish it and relocate in some other township because of water supplies. Artesian wells and occasional successful shallow wells permitted some settlements in the areas where shallow water is not generally found, but dense settlement was discouraged. It took a sizable farm to justify an investment of several hundred or a thousand dollars in a well.

The conservation practices of the Agricultural Adjustment Administration are encouraging development of stock water projects, usually in the form of small dams. Irrigation now proposed would spread run-off water over lowlands to produce livestock feed as a supplement to grazing. Other practices would reduce the amount of run-off on pastures and cultivated fields. Both the earlier and present movements result from periods of low rainfall and water shortage. These things noticeably lost importance during the period of wetter years from 1902-24.

Dry streams and sloughs are often lamented in these times. Their condition is attributed to changing climate, and considered a portender of disaster. It must be remembered that these bodies of water in Hand County have been dry before. In the known history of the county they have been dry three times. It is the opinion of old time residents that it takes abundant snow to refill the lakes and that rains have never been in sufficient quantity to supply more than temporary water. The sloughs were full in 1831 and 1882 when the country was opened to settlement, as a direct result of the winter of 1880-81. By the end of the summer of 1890 the lakes and streams were all dry. It was not until 1896-97 that winter precipitation was adequate to reestablish these as apparently permanent bodies of water.

They were all practically dry again after the seasons of 1910, 1911, and 1913. This time they were dry only a very short time and the sloughs and lakes were full again from 1914 to 1926. This period is most vivid in memories of present day residents, and the dry sloughs and water-ways that developed after 1926 recall those times when stock water, fish, and swimming holes were abundant.

#### WEEDS AND PESTS

Weeds compete for moisture, plant food, and room wherever crops are grown. They should not be overlooked here, where they compete mainly for moisture. Either annual or perennial in habit of growth, some are quite serious. The most important weed in Hand County of perennial nature is field bindweed, sometimes called Creeping Jenny. This weed, if once established threatens to take over fields and entire areas. Once a plant starts, the vigorous root system spreads it rapidly. Getting rid of this weed is extremely difficult and expensive. Others of similar habit, but which are much less tenacious, are quack grass and Canada thistle.

The most common of the annual weeds are wild oats, wild sunflowers, cockleburrs, pursley and pigweed. The weed that takes the largest toll in competing with crops, in contributing to bad appearance, in damaging fences, in collecting drifting soil, and in just plain cussedness, is the Russian thistle, supposedly introduced by Menonites with crop seed from Russia. Could the trouble this weed would cause have been foreseen, patient and thorough eradication would probably have taken place in earlier times before it became entrenched. It has its good side too, for it usually makes some growth in the worst of seasons. In such times it supplies much needed pasture and hay. In some years thistle hay has had an important place in the feed market, in the Northern Great Plains.

An effort was made to eliminate it, but not until the weed was thoroughly spread and had found too favorable a habitat to be easily dislodged. The Press, July 9, 1891 says, "Landowners and overseers of highways must destroy Russian thistles and cockleburrs. If landowners fail to comply with this law they can be fined from \$5 to \$50". In February 1895, a proposal for a national campaign to eliminate Russian thistles is reported. It was not long until the vigor of the weed became apparent, for in May of the same year, "Yes, it has frosted several times, and the Russian thistle gently murmurs 'never touched me'". Yet people still hoped the infestation was just a wave, or flad, and in October, 1895, "The Russian thistle is said to have had its day and is now on the decline". The last hope appeared in 1899 when a bill was introduced in the State legislature that would "demand" every person to get rid of his Russian thistles. After that they ceased to be news, and any person familiar with the "Plains" is well aware that the Russian thistle is far from having "had its day".

Of the numerous insect pests common to the Great Plains, the grasshopper is probably the most serious. George Gilbertson, Extension Entomologist, has pointed out that in South Dakota of the 87 years since 1852, 37 have been grasshopper years and 17 of these have been Statewide in destructiveness. Grasshoppers and other insect pests frequently build up their numbers in dry years, or in periods of successive dry years. Planning must not fail to consider control of these pests, and our hope, Mr. Gilbertson says, lies in farm practices and farm management. Farm practices must be so arranged "that they interfere seriously with the well-being of the pest in question." 23/

Parasitic fungi such as smut, bunt, and rusts prey on crops. The most serious of these, black stem rust, has almost destroyed in a few days abundant wheat crops that were on the verge of maturity. It is first mentioned in the Press in 1904. This was mentioned by an old-timer

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23/ George Gilbertson, South Dakota State Extension Entomologist, address to the Hand County Agricultural Policy Committee and Northern Great Plains Planning Group on Tour, Miller, South Dakota, July 31, 1940. At the time of this writing, Mr. Gilbertson is assembling information to demonstrate graphically the relationship between grasshopper infestations and climate.



as the first year they had a touch of black rust; however, it may have contributed to light wheat crops in earlier years as in 1887 and 1888 when according to the Press, wheat was light and other crops were good. While 1914, 1916, 1919, 1920, 1923, 1927, 1931 and 1935 have brought fairly severe rust infestations in South Dakota, 1916, 1923 and 1935 are outstanding in the memories of Hand County residents as rust years (table 13). Evidence from various sources indicates Hand County suffers less from rust than more humid areas of the Northwest.

Barberry eradication combined with rust-resistant varieties of wheat have been the principal control methods. Mention of durum or macaroni wheat first appears in the Press in 1904, having yielded as high as 22 bushels per acre in that year when rust was prevalent. Because of its resistant characteristic it became fairly popular despite its low quality. In recent years plant breeders have produced selected varieties of hard red wheat, such as Thatcher, which have proven resistant to rust as well as much more desirable than durum in terms of market value. The popular use of resistant wheat varieties had done much to reduce loss from rust.

#### RECAPITULATION

The 78 seasons from 1862 to 1939 can be classified roughly into three categories, good years, fair years, and poor years.

Forty percent, or 31 out of the 78, go into the class of good years, seasons that produced crops that satisfied the farmers. Yields in these years ranged from 20 to 36 bushels per acre for corn; 14 to 22 bushels for wheat, and lower if rust was prevalent; 30 to 50 bushels for oats; 19 to 35 bushels for barley; 12 to 29 bushels for rye; and 8 to 13 bushels for flax. Even in these years individual crops frequently fell below these levels. The highest yields were attained infrequently and marked the seasons of really bumper crops.

Thirty percent or 23 seasons out of the 78 were fair, they produced crops that were disappointing but did not cause hardship generally. Corn yielded 10 to 20 bushels per harvested acre; wheat 9 to 13 bushels; oats 15 to 30 bushels; barley 10 to 18 bushels; rye 8 to 11 bushels; and flax 3 to 7 bushels.

Thirty percent, or 24 of the 78, were in the category of poor seasons that brought crops ranging to total failure. They all brought some degree of general want and privation. Lowest yields were in 1934 when the only yield reported is .2 bushels per acre of corn harvested on 40,000 acres. The acreage in preceding years had been around 120 thousand.

Good years have ample and well distributed precipitation and cool weather. It is especially important that the weather remain cool during any dry spells, and that hot winds be absent. Fair crop



returns are secured under a variety of circumstances. These occur when an otherwise good season is interrupted by a dry, hot, windy spell; when conditions including precipitation are all only moderately good; or when current weather is poor, and a reserve of moisture has been carried over from good seasons. Several seasons with above average rainfall have failed because of climate to produce good crops. Failures have been caused by a variety of adverse combinations of precipitation, temperatures, and winds.

In 60 percent of the seasons in Hand County significant limitations are put on the crop by climate. In terms of production it is an important limiting factor. Plans will recognize it as such. They will expect good years and series of good years interspersed with dry years and series of dry years. Crops planted will include high yielding ones to take advantage of good seasons, and hardy ones to meet the droughts and other natural hazards. Grass stands will be maintained as one of the most reliable producers. Feed and financial reserves will be carried to help through those inevitable seasons where there is no crop nor grass. Tough crops and alert farming are essential.

TABLES

Table 1. - Precipitation by periods, Hand County, South Dakota, 1893-1939 1/

Year	September 1 - March 31		April 1 - July 31		April 1 - August 31		Crop year 2/ Inches: Percent 3/	
	Inches	Percent 3/	Inches	Percent 3/	Inches	Percent 3/	Inches	Percent 3/
1893	6.37:	35	11.35 :	63	12.10:	67	18.47:	102
1894	5.09:	28	6.42 :	35	7.59:	42	12.68:	70
1895	4.85:	27	8.97 :	50	10.64:	59	15.49:	86
1896	3.21:	13	13.98 :	77	15.74:	87	18.95:	105
1897	7.16:	39	11.95 :	66	14.06:	73	21.22:	117
1898	3.79:	21	11.15 :	62	12.14:	67	15.93:	83
1899	4.43:	24	10.02 :	55	13.32:	74	17.75:	93
	:		:		:		:	
1900	3.86:	21	11.09 :	61	18.40:	102	22.26:	123
1901	6.52:	36	10.53 :	58	12.44:	69	18.96:	105
1902	10.46:	58	9.50 :	52	12.53:	69	22.99:	127
1903	4.60:	26	8.92 :	49	11.09:	61	15.69:	87
1904	4.84:	27	9.74 :	54	11.75:	65	16.59:	92
1905	3.04:	17	17.05 :	94	20.43:	113	23.47:	130
1906	4.34:	24	11.39 :	63	16.91:	93	21.25:	117
1907	7.85:	43	10.84 :	60	11.56:	64	19.41:	107
1908	4.19:	23	13.03 :	72	16.29:	90	20.48:	113
1909	6.03:	33	10.24 :	57	13.78:	76	19.81:	109
	:		:		:		:	
1910	7.32:	41	6.94 :	38	9.11:	50	16.43:	91
1911	3.73:	21	7.34 :	41	10.55:	58	14.28:	79
1912	5.80:	32	9.55 :	53	12.53:	69	18.33:	101
1913	2.76:	15	9.78 :	54	11.03:	61	13.79:	76
1914	3.47:	19	15.59 :	86	17.43:	96	20.90:	115
1915	7.21:	40	14.86 :	82	16.48:	91	23.69:	131
1916	7.16:	39	11.09 :	61	16.04:	89	23.20:	123
1917	6.87:	33	8.73 :	48	9.88:	54	16.75:	92
1918	4.95:	27	12.86 :	71	15.55:	86	20.50:	113
1919	5.95:	33	13.39 :	74	14.27:	79	20.22:	112

Continued

Table 1. - Precipitation by periods, Hand County, South Dakota, 1893-1939 1/  
Continued

Year	: September 1 -	: April 1 -	: April 1 -	: Crop Year <u>2/</u>
	: March 31	: July 31	: August 31	
	: Inches: Pct. <u>3/</u>	: Inches: Pct. <u>3/</u>	: Inches: Pct. <u>3/</u>	: Inches: Pct. <u>3/</u>
1920	: 7.09 : 39	: 17.44 : 96	: 19.34 : 107	: 26.43: 146
1921	: 4.89 : 27	: 9.46 : 52	: 12.57 : 69	: 17.46: 96
1922	: 9.95 : 55	: 10.58 : 58	: 11.19 : 62	: 21.14: 117
1923	: 5.10 : 28	: 11.84 : 65	: 15.08 : 83	: 20.18: 112
1924	: 5.47 : 30	: 10.20 : 57	: 13.16 : 73	: 18.63: 103
1925	: 5.67 : 31	: 10.50 : 58	: 11.65 : 64	: 17.32: 96
1926	: 3.03 : 17	: 6.90 : 38	: 8.94 : 49	: 11.97: 66
1927	: 6.15 : 34	: 13.84 : 76	: 15.78 : 87	: 21.93: 121
1928	: 4.07 : 22	: 8.40 : 46	: 10.92 : 60	: 14.99: 83
1929	: 7.26 : 40	: 6.92 : 38	: 7.94 : 44	: 15.20: 84
1930	: 7.18 : 40	: 9.47 : 52	: 12.77 : 71	: 19.95: 110
1931	: 7.16 : 40	: 5.49 : 30	: 6.28 : 35	: 13.44: 74
1932	: 6.14 : 34	: 9.96 : 55	: 12.38 : 68	: 18.52: 102
1933	: 4.79 : 26	: 8.51 : 46	: 9.71 : 54	: 14.50: 80
1934	: 3.22 : 18	: 6.10 : 34	: 7.23 : 40	: 10.45: 58
1935	: 6.02 : 33	: 10.58 : 58	: 13.27 : 73	: 19.29: 107
1936	: 3.22 : 18	: 4.81 : 27	: 7.61 : 42	: 10.83: 60
1937	: 5.11 : 28	: 9.42 : 52	: 10.67 : 59	: 15.78: 87
1938	: 4.13 : 23	: 11.35 : 63	: 12.26 : 68	: 16.39: 91
1939	: 6.10 : 34	: 10.69 : 59	: 11.89 : 66	: 17.99: 99
1893-1901 Ave.	: 5.03 : 28	: 10.61 : 59	: 12.94 : 71	: 17.97: 99
1902-1920 Ave.	: 5.67 : 31	: 11.49 : 63	: 14.03 : 77	: 19.70: 109
1921-1929 Ave.	: 5.74 : 32	: 9.36 : 54	: 11.91 : 66	: 17.65: 97
1930-1939 Ave.	: 5.30 : 29	: 8.62 : 48	: 10.41 : 57	: 15.71: 87
1893-1939 Ave.	: 5.50 : 30	: 10.35 : 57	: 12.61 : 70	: 18.11: 100

- 1/ Records are averaged from Faulkton, Huron, and Highmore since 1895, Gann Valley is included since 1898, Redfield since 1899 and Miller since 1902.
- 2/ Includes from September 1 of previous year to August 31 of designated year.
- 3/ 1893-1939 average for crop year equals 100 percent.
- Compiled from U. S. Weather Bureau data.



Table 2.- Precipitation, daily for April, Hand County, S. Dak. 1902-39

Year,	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total	
Inches																																
02	T.	—	—	—	—	.01	—	.22	—	.08	T.	—	—	—	T.	—	T.	.29	—	—	T.	.46	—	—	—	.18	—	.01	—	.05	1.01	
03	.25	.23	—	—	—	.15	—	—	—	.01	T.	—	—	—	—	—	—	.18	.02	.16	.60	—	—	—	T.	—	—	.03	.17	—	.06	1.86
04	.01	.03	.48	—	—	—	—	—	—	—	T.	—	T.	—	—	—	—	.18	—	—	—	.16	—	—	—	—	—	—	—	.12	1.50	
05	.03	.55	T.	T.	—	—	T.	.23	—	.01	—	—	.18	—	.01	—	—	—	—	—	—	—	—	—	T.	T.	T.	.01	.07	—	.06	.86
06	—	—	—	—	—	—	—	—	.02	.01	—	.76	.96	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.21	2.44	
07	—	T.	—	—	.01	.12	—	—	—	—	—	T.	—	—	—	—	—	—	—	—	—	—	.93	.80	.01	.02	T.	T.	.01	.76	.76	
08	.01	—	—	—	—	—	.08	—	.01	—	T.	—	—	T.	.02	—	—	—	—	T.	.03	—	.93	.80	.01	.02	—	.11	.06	.01	1.87	
09	T.	—	—	—	—	—	T.	—	—	—	—	—	—	T.	.02	—	—	—	—	—	—	—	T.	—	—	—	—	—	—	—	.22	
10	—	—	—	T.	—	—	—	—	—	—	.06	.23	T.	.56	.03	.09	.20	.01	—	—	—	T.	—	—	—	—	—	—	—	—	.99	
11	.01	—	.01	.14	T.	T.	—	—	—	—	—	.74	1.22	.24	.01	—	—	—	T.	T.	—	—	—	—	.07	—	—	—	.27	—	.79	
12	—	—	—	—	T.	—	—	—	—	—	—	—	—	—	—	—	—	T.	T.	.17	.02	T.	.16	—	—	.01	.27	.30	—	.18	2.97	
13	T.	T.	—	—	—	—	.53	T.	.33	.10	—	—	—	—	—	T.	T.	.85	—	.05	—	—	.03	.45	T.	1.31	1.09	.01	T.	.01	1.37	
14	T.	—	—	.14	—	—	T.	—	—	.02	—	—	—	—	—	.02	T.	—	—	—	—	—	.56	.06	—	—	—	—	—	.03	3.96	
15	—	—	—	—	—	—	.48	.15	.41	.01	—	—	—	—	—	.08	.20	T.	.22	.06	—	—	.07	.05	T.	—	—	—	—	.03	.78	
16	—	.06	—	—	—	—	.02	—	—	—	—	—	—	—	.08	.20	T.	.38	.09	—	—	—	.01	.68	T.	—	—	T.	.21	.04	.11	3.23
17	—	—	—	—	T.	.42	.39	—	—	—	—	—	T.	.02	.50	.32	.06	.09	—	—	—	T.	.06	—	—	—	—	—	.02	.26	.36	2.12
18	.10	—	—	—	.12	.02	—	—	—	—	—	—	.02	.79	.10	—	—	—	T.	—	.80	T.	—	—	—	—	—	—	.12	—	—	2.47
19	.15	.01	—	—	—	—	.40	.20	T.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.02	2.47		
20	—	—	—	—	—	—	—	—	T.	—	—	—	—	—	.10	—	—	T.	.75	T.	—	.85	.12	.35	—	—	—	T.	.20	—	2.37	
21	—	—	—	T.	.25	.37	—	—	—	—	—	—	—	—	—	—	—	—	—	1.50	—	—	.10	.25	.08	—	—	T.	—	.08	2.63	
22	—	—	—	.13	.27	.06	—	—	—	—	—	—	T.	.04	—	.35	—	.01	—	—	—	.02	.38	—	—	—	—	—	—	—	1.26	
23	—	T.	—	—	—	—	—	—	—	—	—	.16	.04	—	—	.12	—	—	.10	.01	—	.18	—	.28	.15	.45	.02	—	—	—	.82	
24	—	—	—	—	—	—	—	—	—	—	.08	—	—	—	.11	.01	.02	.08	—	.21	T.	—	.01	—	—	—	—	.01	—	—	—	1.05
25	—	—	—	—	—	—	.08	.44	T.	—	—	—	—	—	—	.01	.02	—	—	—	—	—	.01	.05	—	—	—	—	—	—	—	1.32
26	—	—	—	.12	.01	.08	—	—	—	.02	.03	.26	.34	.58	.19	.55	.07	—	.65	.04	.01	—	—	.05	—	—	—	—	—	—	.26	
27	—	—	—	.43	—	—	.80	—	—	—	.42	—	.35	—	T.	T.	—	.16	T.	—	—	—	—	—	—	—	—	—	T.	3.97	.93	
28	—	—	—	—	—	—	—	—	—	—	.96	.11	—	—	.05	.02	—	.07	.01	—	—	—	T.	1.01	.08	—	—	—	—	.02	2.38	
29	T.	—	—	—	.02	—	.03	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	—	—	—	—	—	—	—	—	—	T.	.01	.06	T.	.34	.01	.12	.95	.01	.03	—	—	—	—	—	—	—	.11	T.	.05	T.	.47	2.16
31	—	.05	.23	—	—	—	—	—	—	—	—	—	—	T.	—	—	—	.06	T.	.23	.03	—	—	—	—	—	—	—	—	—	.57	
32	—	—	—	—	—	—	—	—	.09	.13	—	—	—	—	—	—	—	—	—	—	—	T.	.65	.39	.25	.04	T.	.23	.09	.01	1.94	
33	—	T.	—	—	.13	—	—	—	.58	—	T.	—	—	—	—	—	—	—	T.	T.	—	—	—	—	—	—	T.	—	.11	.80	1.52	
34	—	—	.26	.06	—	—	—	—	T.	—	—	—	—	—	—	—	—	T.	—	—	—	—	—	—	—	—	—	—	—	—	.32	
35	.31	—	.11	.32	—	.48	—	—	.03	.93	.44	—	—	—	—	—	—	—	—	—	—	—	—	.80	.94	.19	.19	.62	.04	.17	5.47	
36	—	T.	—	.03	.04	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	T.	.77	.22	.17	.07	—	—	T.	.12	1.17	1.36
37	T.	.29	.15	—	—	—	—	—	—	—	.06	—	—	T.	.07	.61	.03	.22	—	T.	—	—	.32	.03	1.41	.02	1.34	T.	.05	.03	.01	1.80
38	T.	—	—	T.	—	1.17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5.28
39	—	—	.02	—	T.	—	T.	—	T.	—	T.	—	—	—	.13	.33	.03	T.	T.	T.	—	—	—	—	.02	T.	—	—	—	—	—	.53

Bureau of Agricultural Economics. Compiled from U. S. Weather Bureau Data. T. Trace, or precipitation less than .01 inch.

Table 3.- Precipitation, daily for May, Hand County, S. Dak. 1902-39

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	
02	.04	—	T.	—	.36	.03	—	—	.06	—	—	—	—	—	.22	.01	—	.01	.23	—	—	—	—	.34	—	—	—	—	—	—	—	—	1.29
03	T.	—	T.	—	—	—	—	.01	T.	T.	—	—	—	—	—	.03	1.97	.08	—	—	—	.02	.16	.05	.07	—	.48	—	—	—	—	—	.79
04	—	—	—	T.	.06	T.	—	T.	—	—	.29	.04	T.	—	.03	1.97	.08	—	—	—	.03	—	.07	.18	.01	.18	.01	—	T.	—	—	—	2.97
05	.64	1.13	1.10	T.	—	—	—	.65	1.33	—	—	—	T.	—	.12	.04	—	—	—	—	.07	—	.15	—	T.	.23	T.	T.	.67	—	—	—	6.42
06	.48	—	.02	T.	T.	—	.11	—	—	.04	—	—	.90	.20	—	—	—	—	—	—	.01	—	.13	1.26	1.28	.85	T.	T.	.69	.01	—	—	5.94
07	—	.01	—	.22	—	T.	.22	—	—	—	—	—	.08	.01	—	—	.14	—	—	—	T.	1.01	.98	1.96	.16	—	.16	—	.01	.38	.01	5.23	
08	—	—	—	—	—	—	—	—	—	.01	—	T.	.98	2.04	.02	—	—	—	.01	—	—	—	—	.27	.02	.30	.12	.02	.01	—	—	3.79	
09	—	—	.01	—	—	.10	—	—	—	—	—	—	T.	.20	—	—	.60	—	.01	—	1.10	.12	—	1.58	.34	—	—	—	.15	.05	.25	4.61	
10	.04	—	—	—	.28	.32	—	—	—	.18	.04	—	—	—	T.	.05	.05	—	—	—	—	—	—	—	—	—	—	.03	—	—	T.	.99	
11	—	—	—	—	—	—	T.	—	T.	.18	.02	—	—	—	—	—	—	.01	T.	.10	—	.30	—	—	—	—	.75	.35	—	1.11	—	2.82	
12	—	.17	.01	.97	—	—	—	—	—	.03	—	.05	—	—	.65	.04	.08	.32	1.16	.16	.07	.02	—	—	.18	.42	.02	.10	—	—	—	1.90	
13	.02	.31	—	—	—	.02	.10	—	—	.01	.33	—	.01	—	—	—	—	—	.02	.16	—	T.	.27	—	—	.12	—	—	—	—	—	.20	3.63
14	—	.25	.01	.19	.01	T.	.01	—	.01	.13	—	—	T.	—	.26	T.	—	—	.22	.21	.17	—	—	.07	.10	.83	.32	.15	.08	T.	—	.04	1.59
15	1.32	.15	.01	.02	.06	—	.04	—	—	—	—	T.	.19	.76	.20	T.	—	—	—	.12	1.41	.17	—	.31	—	—	—	—	.15	.27	—	3.83	
16	T.	.04	—	—	—	—	—	—	T.	.01	—	—	—	—	—	—	—	.01	—	.60	.50	—	—	—	—	.03	.37	—	—	—	—	1.66	
17	—	—	.14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.32	.03	.02	.15	—	—	—	—	.06	.30	.02	.03	T.	1.10	.33	3.29
18	—	—	—	—	.04	.07	—	—	.82	—	—	—	—	—	—	—	—	.25	—	—	—	—	—	—	—	—	—	—	—	—	—	5.27	
19	—	.70	.52	T.	.10	.80	.04	—	—	T.	.60	.10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.09	1.07	—	
20	—	—	.85	—	—	.10	—	—	—	1.10	1.40	1.50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.40	—	—	.17	.35	6.87	
21	—	—	—	—	—	—	.45	.20	.10	—	—	.33	T.	—	.95	.27	.10	.05	.18	—	—	.35	.10	—	—	.19	.47	—	—	.16	3.25		
22	.09	.22	—	—	—	—	T.	.05	.08	1.25	—	—	T.	.04	.02	.27	—	—	.19	—	—	.12	—	—	—	.17	T.	.13	.05	.26	—	3.16	
23	.13	—	—	—	—	—	.04	.01	—	.11	.01	—	T.	—	—	.04	T.	—	.05	T.	—	T.	.12	T.	—	T.	—	—	—	.30	.02	.96	
24	—	—	—	—	—	T.	.10	.21	.11	—	T.	—	.01	—	—	—	—	—	—	—	—	.69	—	—	—	.02	—	—	—	—	.02	.66	
25	—	—	T.	—	—	—	.03	.65	.33	—	—	T.	.01	—	.33	T.	—	T.	—	—	—	.69	—	—	—	—	—	—	.04	—	T.	1.12	
26	—	—	—	—	—	.12	.01	.65	.33	—	—	—	.12	—	—	—	—	.06	T.	.40	.13	T.	.43	T.	—	—	.06	.45	T.	.09	T.	2.16	
27	—	—	.02	T.	—	.28	.42	.68	.10	.05	—	.04	—	.02	—	—	—	—	.08	—	—	—	—	—	—	—	.14	T.	—	—	—	2.86	
28	—	.30	.15	—	—	—	—	—	.16	.03	.10	—	T.	T.	.28	T.	T.	—	—	—	—	—	—	—	—	—	—	—	.35	—	—	1.16	
29	.05	—	—	—	—	—	—	—	—	—	—	—	—	—	.03	—	—	T.	—	—	—	—	—	—	—	—	—	1.69	.38	—	.07	2.51	
30	—	—	—	.20	—	1.02	.55	.16	.19	.03	.99	.80	.01	—	—	—	—	—	—	.06	.10	—	—	—	—	—	—	—	—	—	—	4.05	
31	.01	—	—	T.	—	—	—	T.	.73	.40	.06	—	—	—	—	—	.03	T.	T.	—	—	—	—	—	T.	—	—	—	—	T.	—	1.68	
32	—	—	.03	.02	.21	.02	.20	.06	—	—	—	—	—	—	.40	—	—	—	—	.01	.05	—	—	—	.08	.65	.01	—	.01	.53	—	2.27	
33	.06	—	—	—	—	—	.67	T.	.08	.25	.08	.18	.06	—	—	—	—	—	—	—	T.	.80	.22	—	—	—	—	.50	—	—	—	2.91	
34	—	.03	.02	—	—	—	—	—	—	—	—	—	—	—	—	.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.07	
35	.11	.06	—	—	—	—	.13	—	.02	.33	—	—	—	—	.01	—	.01	—	.04	.06	.22	—	—	—	—	.03	—	—	—	.06	—	1.01	
36	T.	—	—	—	—	—	.04	.14	.65	T.	—	—	—	—	—	—	T.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.11	
37	.28	.07	.05	—	—	—	.08	T.	—	—	.03	T.	—	—	.16	—	—	.39	.14	.06	—	—	—	T.	—	—	—	—	T.	.39	1.57	3.24	
38	T.	.40	.16	—	—	—	—	—	—	—	—	—	.04	—	—	.42	.14	.39	.14	.06	—	T.	—	—	—	—	—	—	—	.62	.01	2.48	
39	T.	—	—	—	—	T.	T.	—	—	—	—	.42	—	—	—	—	—	—	T.	.38	.45	.15	.81	—	.08	.07	.57	—	—	—	—	2.93	

Bureau of Agricultural Economics. Compiled from U. S. Weather Bureau Data. T. Trace, or precipitation less than .01 inch.

Table 4.- Precipitation, daily for June, Hand County, S. Dak. 1902-39

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total		
Inches																																	
02	.87	—	—	T.	—	.52	.03	—	—	T.	.01	—	.84	.05	—	—	T.	.24	.10	.02	.01	—	—	—	1.96	—	.33	.01	.04	.14	.60	5.51	
03	.05	—	.63	.03	.11	—	.01	.01	T.	.09	—	.06	T.	.01	.03	—	—	—	.05	.03	.03	—	T.	.09	.58	.01	—	—	.13	T.	—	2.84	
04	.05	—	—	T.	.01	T.	—	.74	.01	T.	T.	—	—	.01	.79	.50	—	.77	.05	.05	.01	—	.03	.32	.54	.13	T.	2.02	T.	—	—	1.82	
05	—	—	.01	.05	—	.05	T.	—	—	—	—	—	—	.14	—	—	.46	.02	T.	T.	T.	—	.10	.02	.52	T.	—	—	.01	T.	1.38		
06	.07	.08	.01	.04	—	.02	.14	.01	.02	.25	—	—	.12	1.00	.48	—	—	—	—	—	—	.14	.28	.04	—	—	—	.05	—	.22	2.58		
07	.17	.21	.01	1.30	.10	.02	.72	.27	—	—	.14	.06	—	—	—	—	.18	.50	—	.48	.28	.04	—	—	—	—	—	—	—	.01	4.49		
08	.18	.01	—	—	.11	—	—	T.	T.	—	.30	.89	T.	—	—	—	—	—	—	.01	.01	.07	.40	.17	T.	—	.35	—	—	—	2.50		
09	.09	.04	.40	—	—	—	—	1.20	.06	—	—	—	—	T.	.01	—	—	—	.04	—	—	—	T.	—	.59	.52	—	—	—	—	—	2.65	
10	.11	.01	.02	.05	—	—	—	T.	—	.02	—	—	.01	.81	1.47	.12	—	—	—	—	—	T.	—	T.	—	—	—	.23	T.	—	—	.41	
11	—	.09	.01	.30	—	—	—	T.	—	T.	—	.01	.34	.06	—	T.	—	—	T.	T.	T.	—	.36	.03	—	T.	.01	—	—	.83	T.	1.66	
12	—	.14	.87	.43	.28	.64	.11	.48	—	1.06	—	.61	.95	.20	—	.05	—	—	T.	.06	T.	—	.38	—	—	—	T.	.77	.50	—	.45	6.55	
13	—	.16	.03	.19	.12	.11	T.	—	—	—	.10	.17	.02	.04	.02	—	.46	T.	.02	.20	.02	.21	.38	—	—	T.	.77	.50	—	.04	4.17		
14	.15	.16	—	.20	.50	.01	T.	—	—	.08	.02	.15	—	.03	.02	—	.10	.10	—	.21	.35	.07	—	—	—	T.	.72	T.	—	—	2.59		
15	—	.17	.10	.19	.07	T.	.16	.25	—	—	.72	.01	T.	—	—	—	T.	—	.02	.02	—	.01	.13	.16	—	T.	T.	T.	—	—	1.82		
16	—	.18	.06	T.	1.07	.63	.06	—	.10	—	—	—	—	—	—	.15	.05	—	T.	.03	—	.08	—	—	—	.73	—	T.	.18	T.	—	3.14	
17	—	—	.03	.80	.26	—	—	.72	—	—	.13	—	—	—	—	—	—	—	.04	.78	.02	—	—	—	—	—	—	—	—	—	—	2.78	
18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
20	—	—	.40	.30	—	.95	—	—	—	.60	—	—	—	.65	.65	—	—	—	—	.05	.25	—	—	—	.50	T.	—	.40	.49	—	2.75	7.89	
21	.46	—	—	—	—	—	—	—	—	—	—	—	—	T.	T.	—	—	—	—	—	—	—	—	—	—	—	—	—	.60	—	—	1.06	
22	—	.06	—	—	—	—	—	.88	.20	.05	—	—	—	.01	.75	.17	—	.02	—	.05	—	—	—	—	—	.32	—	.23	.01	T.	.47	3.22	
23	—	—	T.	—	.16	.03	.27	.12	.15	—	—	—	—	.65	T.	—	.20	—	.95	—	—	.34	.06	—	—	—	T.	.06	.72	1.62	.23	—	7.10
24	.02	T.	T.	—	.12	.03	1.24	.40	.22	—	.02	.17	T.	.75	T.	.42	.21	.18	—	—	T.	—	.16	.01	.16	.62	.06	—	—	—	—	5.21	
25	.33	.49	—	—	.08	.66	1.30	.05	—	.10	.42	.06	.17	.03	.02	.44	—	—	.01	T.	—	.16	1.13	—	—	—	—	—	—	—	—	5.21	
26	—	.26	.02	—	—	—	—	—	.02	.06	—	—	—	.04	.01	.40	T.	—	—	.01	T.	—	T.	.01	—	.03	—	—	—	T.	—	1.82	
27	.18	.10	.15	T.	—	.02	—	T.	T.	—	.14	—	—	—	—	—	T.	—	.23	.44	.03	.10	—	—	—	—	—	—	.51	.02	1.89		
28	—	—	—	—	T.	—	.01	—	—	.35	.10	T.	—	.17	.11	—	—	.23	T.	—	.14	.07	.93	.03	—	—	—	.22	.01	.01	—	2.38	
29	—	.01	.09	.01	—	.01	—	—	—	T.	.73	.01	.26	—	—	—	—	—	T.	—	—	—	.02	.06	—	—	—	—	—	—	.01	1.20	
30	—	—	.68	.06	.01	—	—	—	—	—	—	—	—	—	—	T.	—	.01	.01	T.	—	.06	.39	1.30	.65	—	—	—	T.	—	—	5.20	
31	T.	.01	—	.01	—	.19	—	—	.16	.50	T.	T.	—	.18	.25	—	—	.01	.89	T.	—	.02	—	—	—	—	—	—	—	—	—	2.21	
32	—	1.18	—	—	—	—	—	.06	T.	.35	.02	—	.68	.29	—	.10	1.30	—	.30	.12	T.	—	.90	—	—	.12	.02	—	—	—	—	4.54	
33	—	—	—	—	—	T.	.24	.16	—	—	.18	—	—	—	—	—	—	—	.70	.28	—	.09	—	—	—	—	.70	—	—	.10	—	2.28	
34	.28	.06	.31	—	—	.20	.08	—	—	—	—	—	T.	.55	.01	.11	.28	—	.70	.28	—	.09	—	—	—	—	—	—	—	—	—	2.65	
35	.04	—	T.	—	—	—	—	.34	—	—	—	—	—	.01	.01	T.	—	—	—	—	.02	1.05	—	—	.18	—	—	—	—	—	—	1.56	
36	.04	—	—	—	.11	.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.61	—	—	—	—	T.	—	—	T.	—	—	1.32	
37	.01	—	—	.20	.28	.05	—	—	—	—	—	1.58	.02	—	—	—	.67	—	—	—	—	—	—	—	—	T.	—	—	.19	—	—	2.98	
38	.06	—	—	—	—	T.	—	—	T.	—	—	—	—	T.	—	—	.53	.53	—	—	—	—	.61	—	—	—	T.	—	.06	T.	—	2.14	
39	.97	.19	—	—	—	—	.22	—	T.	3.01	.10	T.	.03	.24	—	1.65	—	—	—	—	T.	.56	.04	—	—	—	T.	.26	1.35	.04	—	—	8.66

Bureau of Agricultural Economics. Compiled from U. S. Weather Bureau Data. T. Trace, or precipitation less than .01 inch.



Table 5.--Precipitation, daily for July, Hand County, S. Dak. 1902-39

Year:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	
Inches																																	
02	.01	—	.01	.01	—	T.	—	.35	—	—	—	—	—	.05	—	.14	.17	—	.98	—	—	.07	—	.10	—	.04	.15	—	.03	.10	1.66		
03	—	.07	.05	.34	—	—	.07	.01	.04	T.	—	—	.38	—	—	—	.17	—	—	.18	T.	—	—	.06	—	—	—	—	—	.13	2.85		
04	—	—	T.	—	.13	—	—	—	.10	.13	T.	—	.01	—	—	—	.18	T.	—	T.	—	T.	—	.06	—	—	—	1.34	—	.15	2.60		
05	—	.90	.74	.03	.05	.05	.01	—	—	—	—	.11	.05	.60	—	.01	.43	—	—	T.	—	—	—	T.	—	.05	—	—	.23	.01	2.20		
06	—	.09	—	—	—	—	—	—	—	—	—	.05	.15	.37	—	—	.53	—	.18	—	T.	T.	.05	.35	—	.29	—	—	T.	T.	1.35		
07	.16	—	—	—	.08	T.	.01	.09	T.	.08	—	—	—	—	.15	.07	—	—	.15	—	—	—	—	T.	.30	—	—	.15	T.	—	—	2.39	
08	.40	—	—	T.	.15	.13	—	T.	—	—	T.	—	—	—	—	—	—	—	—	—	—	—	—	T.	—	—	—	—	.83	—	—	1.56	
09	1.71	—	.01	1.32	.30	T.	T.	.53	.23	—	.22	.08	—	.08	—	—	—	—	.15	—	—	—	—	.15	—	—	—	—	—	—	—	5.52	
10	—	.01	—	—	.25	—	—	T.	.61	—	.30	—	.05	T.	—	—	—	.11	—	—	—	.56	—	.24	—	.03	—	—	T.	—	—	1.61	
11	—	.04	.02	.09	—	—	—	.68	.40	—	—	T.	—	.02	—	.01	.31	.03	.11	T.	T.	.37	—	—	—	.02	—	—	.01	.01	—	2.14	
12	.04	.04	—	.34	.19	—	—	—	.27	—	.03	—	—	—	T.	.35	.41	—	—	—	—	T.	T.	T.	.05	—	—	.02	—	—	—	1.73	
13	.01	—	.07	T.	—	—	—	.30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	T.	—	—	—	—	—	—	—	2.76	
14	—	—	—	—	—	.85	—	—	—	—	T.	—	—	—	—	—	—	—	—	—	—	—	T.	T.	.02	—	—	—	.10	—	—	.95	
15	.05	.01	.08	—	—	T.	—	T.	—	.01	.25	.35	.14	1.51	.01	.93	.10	.02	—	—	—	T.	T.	.02	.04	1.17	.03	T.	.08	T.	.36	4.21	
16	—	—	—	—	—	—	—	—	—	—	.03	—	—	—	—	—	T.	.27	—	—	—	—	—	.02	.01	.02	—	—	.06	.13	T.	1.39	
17	—	—	—	—	.50	—	—	—	—	—	—	.50	—	T.	—	.53	T.	—	—	—	T.	—	—	—	—	—	—	—	—	.03	.49	1.52	
18	—	—	T.	—	T.	.13	T.	—	—	—	T.	.03	—	1.28	T.	—	—	T.	.65	—	—	.11	—	.01	.35	—	—	T.	—	—	—	4.25	
19	—	—	1.02	—	.11	—	—	—	—	—	—	—	—	—	—	—	.30	—	.09	—	—	—	—	—	—	—	.07	.18	—	.03	—	1.80	
20	—	—	—	T.	.80	—	.10	—	—	—	—	—	1.29	—	—	—	—	1.00	—	—	—	—	—	.70	—	—	—	—	—	—	—	2.60	
21	—	—	.95	T.	1.46	.10	—	—	—	.07	—	—	—	—	—	—	—	—	—	—	—	—	—	.22	—	—	—	—	—	.03	—	4.53	
22	—	T.	—	.02	—	.18	—	.43	—	—	—	—	—	.05	T.	.01	.04	.20	—	.04	—	—	T.	.24	.02	—	.20	.02	—	T.	—	1.36	
23	.03	.02	—	1.02	—	.37	—	—	—	1.33	—	—	—	—	—	.23	.44	.31	.53	—	—	—	—	—	—	.22	—	—	1.21	—	—	4.52	
24	—	.35	.01	—	—	.99	T.	.07	—	—	—	.02	—	—	T.	.03	.44	.31	.53	.05	.23	T.	.11	—	—	—	.01	.11	—	.06	1.58		
25	—	—	—	—	—	—	—	—	—	—	—	—	—	.02	—	—	—	—	—	.05	—	—	.36	—	—	—	—	T.	T.	—	—	1.40	
26	.17	—	.07	—	—	—	—	T.	—	—	—	—	—	—	—	—	—	—	—	.02	.23	—	.39	—	—	—	—	—	.03	—	—	1.17	
27	—	.12	.07	T.	—	—	—	—	.24	—	.08	.31	—	T.	1.15	.66	.05	.56	1.27	.07	—	—	—	—	—	—	—	—	T.	T.	—	2.17	
28	T.	.29	.13	—	.41	.24	.01	.03	—	T.	—	.12	—	.30	—	—	.09	T.	T.	.18	.01	.19	—	—	—	—	—	—	—	—	—	2.63	
29	—	—	—	—	T.	.37	.01	.03	—	—	—	.12	—	.30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.30	
30	—	—	—	.01	—	.15	—	—	—	—	—	T.	—	—	—	—	—	T.	.34	—	—	T.	—	.09	.05	—	—	—	T.	.09	—	.73	
31	.74	—	—	.33	—	—	—	.03	—	—	—	.05	—	T.	—	—	—	T.	—	—	—	T.	—	—	T.	—	—	—	T.	—	.17	1.32	
32	—	—	.51	—	—	T.	T.	—	—	—	—	.05	—	—	—	—	—	—	—	.36	T.	.20	—	.31	—	—	—	—	—	—	—	.82	
33	—	.12	—	—	.57	.70	.05	—	.90	.14	.80	—	—	—	—	—	—	—	—	T.	—	T.	1.18	.25	1.32	T.	—	—	—	—	—	3.84	
34	—	—	—	—	1.01	—	—	—	—	—	—	.94	.15	—	T.	—	.05	—	—	.36	.22	T.	.26	—	—	—	—	—	—	—	—	4.85	
35	—	—	—	—	.02	—	—	.54	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.04	—	—	—	—	—	—	1.09	
36	—	—	—	—	—	—	—	—	—	—	—	—	.04	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.15	
37	—	—	—	—	—	—	—	—	—	.05	—	—	—	—	—	—	.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
38	—	—	—	—	T.	T.	.18	1.17	—	—	—	—	1.56	.08	—	—	T.	.08	—	—	—	—	—	.05	—	—	—	—	.47	—	—	—	
39	—	T.	.10	.30	.06	T.	.03	—	T.	.06	—	—	—	—	—	.53	T.	—	T.	—	T.	—	—	—	.63	.01	.46	—	.03	T.	—	—	1.53
																																1.85	

Bureau of Agricultural Economics. Compiled from U. S. Weather Bureau Data. T. Trace, or precipitation less than .01 inch.

Table 6.- Precipitation, daily for August, Hand County, S. Dak. 1902-39

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	
Inches																																	
02	.02	T.	.06	—	—	—	.70	.06	.07	.17	—	—	—	T.	.30	.01	—	—	1.13	—	.12	.33	.01	—	.19	.08	—	—	—	.18	.43	.01	2.48
03	.02	—	—	—	—	—	.07	—	—	—	—	—	—	—	T.	.04	—	T.	—	—	.25	.12	.20	—	.19	.08	.10	.33	.07	.02	—	—	2.26
04	—	—	—	—	—	—	—	.07	—	—	.02	.10	.31	—	T.	.09	.01	.76	—	—	.25	.30	.30	—	—	—	—	—	—	T.	.03	.16	1.33
05	2.02	.01	—	—	—	—	—	—	—	—	.03	—	—	T.	—	—	—	T.	—	T.	1.10	.06	.17	.01	.02	—	—	—	—	—	—	.21	3.08
06	.97	—	.23	.18	—	1.72	.20	.67	—	—	—	—	—	T.	—	—	—	.05	—	.06	.01	—	—	—	—	—	T.	—	T.	.06	—	—	5.37
07	—	—	—	.54	—	—	.06	—	.01	—	—	—	.01	.03	—	—	—	—	—	—	T.	—	—	—	T.	—	—	—	—	—	T.	.63	
08	—	T.	—	T.	.31	1.10	1.56	T.	.66	—	—	.17	.20	1.50	.23	—	.04	—	—	—	—	—	—	.02	—	—	—	—	—	—	1.18	3.28	
09	—	—	—	—	—	—	—	—	—	—	—	—	.10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3.79	
10	.05	T.	—	—	—	.01	.19	—	—	.03	—	.10	.20	—	—	T.	—	—	T.	—	—	—	—	.33	.03	—	—	—	T.	—	—	.58	
11	—	2.00	1.89	—	.20	.18	.16	—	.03	T.	—	—	—	—	—	.03	.02	—	—	.03	—	—	—	—	—	—	—	—	—	—	—	—	4.87
12	—	—	—	.03	.03	.33	.01	.06	T.	.06	.01	.05	.01	—	.67	.53	.60	.36	.45	—	—	—	T.	—	—	—	—	—	—	.01	.25	.01	3.41
13	—	—	—	T.	—	—	.35	.03	T.	.38	.01	.05	—	—	.02	.09	.01	T.	.04	.06	—	—	—	—	—	—	T.	—	—	—	—	—	1.04
14	T.	—	—	.46	—	—	—	—	—	.20	—	—	—	.01	—	—	—	—	T.	.01	.09	.09	—	.68	—	.24	.06	.43	—	—	—	2.18	
15	.30	.41	.01	—	—	—	—	—	—	.15	.95	—	—	.14	.01	—	—	—	—	1.35	2.93	—	—	—	—	—	—	.01	—	—	—	—	6.13
16	—	—	—	.01	T.	.08	—	.07	—	.15	.74	.10	—	.61	—	—	T.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.42	
17	—	.05	—	.03	.42	.11	.13	.13	.16	.11	.74	.10	T.	—	T.	.01	T.	.30	—	.06	—	—	T.	—	—	—	T.	—	—	.01	—	1.60	
18	—	—	—	.17	.30	.47	—	—	—	.23	T.	.53	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.97	
19	—	.01	—	T.	—	—	—	T.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.07	
20	—	—	.40	—	.35	—	—	T.	—	.35	.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.70	—	—	—	2.00	
21	.35	—	—	.02	—	—	—	.43	—	—	.08	—	—	—	.93	.84	—	—	—	—	—	—	—	—	T.	—	—	.90	—	—	—	4.41	
22	—	.41	—	.01	.01	—	—	—	—	.22	—	—	—	—	—	—	—	.40	—	—	—	—	T.	—	.51	.23	—	—	—	—	—	.92	
23	—	.05	.09	—	—	.42	.22	.09	.36	.46	—	—	—	—	.06	—	—	—	—	—	.92	—	—	—	—	—	—	—	—	T.	—	—	2.49
24	.16	.03	.03	—	—	.23	—	—	—	—	—	—	T.	.01	—	—	—	—	—	—	—	—	—	—	.02	.08	—	—	—	—	—	1.38	
25	—	—	—	T.	—	—	—	.02	—	.12	—	—	—	—	—	—	—	—	—	—	—	T.	—	—	—	—	T.	—	.07	—	—	—	.40
26	—	—	—	.63	.03	—	T.	.07	1.82	.01	.28	T.	.10	—	.37	—	—	—	T.	—	1.09	—	—	—	—	—	T.	—	—	—	—	—	4.40
27	—	—	—	—	—	—	—	—	.03	.52	—	.12	T.	—	.09	—	.13	.02	—	—	—	.05	—	—	—	—	.30	—	—	—	—	1.21	
28	.15	—	—	—	.29	—	—	—	—	—	—	—	.01	—	T.	.51	—	.08	—	.14	—	—	—	—	—	—	T.	.03	.50	—	T.	2.07	
29	T.	—	—	—	—	—	—	.35	—	—	.03	—	—	—	—	—	—	—	.01	—	T.	—	T.	—	—	—	—	.10	—	—	—	.50	
30	.13	T.	.15	—	—	.22	.23	—	—	—	—	—	—	—	—	T.	.03	1.41	—	—	1.09	—	—	—	—	—	.03	.03	—	—	—	3.32	
31	T.	—	—	—	—	.01	T.	—	—	—	.31	.13	T.	—	T.	—	—	—	—	—	—	—	.53	—	—	—	.06	—	—	.02	—	.62	
32	T.	.60	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	T.	—	—	—	.14	—	—	—	1.18	
33	T.	.08	—	—	—	—	—	.11	—	—	.50	—	—	—	—	—	—	—	T.	.06	.30	.07	—	—	—	—	.05	—	—	—	—	.67	
34	—	—	—	—	—	—	—	.41	—	—	—	—	—	.25	—	—	—	—	—	—	—	T.	—	—	—	—	—	—	—	—	—	—	—
35	.08	.92	—	.13	—	—	.22	.10	—	—	—	—	—	—	—	—	T.	—	—	.15	.07	—	.01	—	—	.34	—	—	.32	—	—	2.38	
36	—	.05	—	—	—	—	—	—	T.	—	—	T.	T.	.14	—	.12	—	.41	.20	T.	.83	—	—	T.	—	—	—	—	—	—	—	2.57	
37	T.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	T.	—	—	.05	—	—	—	.02	—	—	—	—	T.	.64	.15	—	.86	
38	—	.02	.22	—	.22	—	T.	—	.15	T.	—	—	—	—	—	—	—	T.	1.66	—	—	—	—	T.	—	—	—	—	—	T.	—	—	2.27
39	T.	—	—	—	—	T.	T.	—	.38	.08	T.	—	—	—	—	—	—	—	—	T.	—	—	—	—	—	—	—	—	T.	—	—	.46	

Bureau of Agricultural Economics. Compiled from U. S. Weather Bureau Data. T. Trace, or precipitation less than .01 inch.





Table 8.--Temperatures, daily maximum for May, Hard County, S. Dak. 1902-39

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Ave.	
Degree Fahrenheit																																	
1902	80	76	62	70	62	68	83	61	60	60	78	79	79	73	61	77	87	82	72	78	79	78	78	74	68	61	73	81	81	75	73	73	
1903	63	60	68	75	60	70	74	78	65	62	62	70	77	81	84	85	84	79	74	78	77	78	72	65	76	78	76	75	82	72	71	66	73
1904	78	77	78	76	70	75	72	70	70	74	66	59	55	69	75	55	63	66	70	76	79	80	86	70	54	58	64	75	82	72	88	67	71
1905	70	57	48	44	56	61	57	54	47	52	44	66	67	75	61	63	66	68	74	80	83	80	80	77	59	54	68	67	63	75	83	65	
1906	51	68	77	60	50	55	59	69	71	88	94	83	77	76	81	83	70	69	67	83	80	73	73	76	69	49	58	57	55	72	63	70	
1907	66	41	52	52	60	50	34	74	51	47	78	66	56	45	67	84	68	65	55	56	82	65	68	57	57	55	69	76	71	57	62	61	
1908	50	56	57	58	61	63	65	72	76	72	79	79	59	53	73	82	80	81	87	77	56	78	75	59	62	74	73	60	62	63	68	68	
1909	40	53	69	91	91	64	71	65	61	71	83	74	74	77	71	71	78	71	73	73	73	74	71	61	57	67	68	78	85	69	65	71	
1910	50	57	60	64	53	45	56	80	74	65	52	62	70	80	66	53	72	88	77	55	64	79	70	70	68	75	77	77	75	80	73	67	
1911	52	59	65	65	73	80	76	84	98	82	65	72	88	91	88	88	95	96	78	65	74	66	75	85	79	80	68	63	72	74	86	77	
1912	76	72	80	67	68	66	68	79	87	70	64	61	59	70	58	67	87	65	63	67	65	80	75	80	83	75	62	84	86	76	72	77	
1913	49	43	66	69	67	64	70	62	58	66	74	78	65	57	74	62	65	44	47	54	68	85	55	55	57	85	93	92	92	82	86	67	
1914	65	55	65	70	59	49	55	67	86	65	48	56	65	66	73	71	74	78	78	84	75	74	61	83	83	85	80	79	77	87	80	71	
1915	62	50	44	61	67	56	66	61	73	88	85	86	80	74	68	56	61	57	58	45	54	67	73	73	71	60	52	49	53	66	72	64	
1916	53	50	75	81	90	94	94	77	90	75	66	57	48	45	45	65	57	70	68	60	61	75	70	70	79	71	74	76	77	74	75	70	
1917	57	55	44	55	64	66	66	64	73	67	70	69	72	78	84	91	85	88	71	62	58	65	69	74	59	59	67	73	70	57	65	68	
1918	83	83	92	91	88	74	78	85	65	60	69	58	71	84	88	85	74	72	64	62	65	65	66	85	66	53	54	58	69	85	73	73	
1919	65	61	55	47	45	56	54	67	70	72	58	62	69	72	58	71	73	73	75	73	76	80	81	83	82	83	86	88	87	84	61	70	
1920	55	69	50	50	65	62	78	80	78	83	55	54	76	65	60	53	71	75	79	80	84	70	75	85	84	73	74	75	79	70	59	70	
1921	58	60	67	69	72	75	65	65	70	75	80	65	45	52	60	45	55	65	80	85	86	88	74	70	73	78	80	80	66	60	68	69	
1922	72	82	67	72	64	69	76	78	74	72	63	67	57	55	68	65	64	72	80	81	68	73	81	73	78	80	80	66	60	68	69		
1923	75	79	65	69	74	68	61	46	74	68	61	63	63	70	64	61	78	75	69	71	64	72	74	74	80	83	87	81	70	79	84	71	
1924	57	67	69	68	67	67	38	41	39	58	61	67	49	57	64	66	57	57	55	58	67	66	58	52	59	61	60	60	60	59	72		
1925	61	74	65	61	55	62	60	61	65	61	72	83	75	74	62	55	45	79	96	95	95	84	66	57	70	64	71	77	88	96	92	72	
1926	88	72	75	97	90	85	68	68	61	65	65	68	65	70	87	77	74	74	72	84	65	85	100	101	92	89	82	80	80	92	81	79	
1927	79	76	60	51	61	56	50	59	55	48	62	72	66	63	67	81	78	59	59	55	72	72	71	67	69	70	63	54	52	60	64	64	
1928	90	73	80	69	75	85	95	92	93	77	66	71	70	70	63	70	78	75	75	66	75	87	90	87	82	75	72	72	81	79	77		
1929	48	57	52	51	55	58	59	57	55	64	68	73	77	82	68	74	73	67	62	64	77	87	71	81	86	84	81	71	73	80	80	68	
1930	77	77	84	73	68	63	58	68	67	53	54	64	47	49	59	56	48	56	73	85	88	64	63	75	82	85	80	66	64	71	81	67	
1931	75	65	77	70	47	61	66	58	47	47	60	65	73	85	97	83	77	69	59	50	52	72	88	87	91	94	86	68	78	81	68		
1932	63	79	66	74	73	57	49	59	71	70	77	82	92	90	85	63	73	87	93	90	76	87	81	84	73	66	58	65	70	73	72	74	
1933	46	63	62	64	65	60	49	47	46	53	53	68	74	82	88	88	89	68	77	73	80	94	76	74	75	73	76	74	68	74	94	69	
1934	78	78	65	73	84	87	92	103	81	74	76	74	66	75	88	92	97	104	101	98	90	84	76	76	85	87	97	103	103	107	100	87	
1935	50	45	42	54	66	70	67	69	70	70	71	66	67	63	66	66	65	67	66	73	72	68	63	70	69	69	72	72	68	69	70	66	
1936	47	58	74	74	88	86	67	64	54	55	72	77	63	79	96	88	75	73	83	85	82	73	83	86	85	79	85	84	90	81	76		
1937	50	61	68	67	74	78	76	60	68	73	73	62	59	72	73	72	71	61	58	74	65	72	78	73	68	72	77	83	85	67	61	69	
1938	82	77	70	63	59	56	49	60	65	66	66	64	64	65	68	64	60	60	59	54	57	73	68	75	74	74	68	77	72	61	71	66	
1939	85	81	82	85	88	83	74	70	75	69	63	64	70	71	85	84	82	87	86	83	79	70	71	77	73	70	66	82	91	92	85	78	
Ave.	64	65	66	67	68	67	66	68	68	67	67	68	67	70	72	71	72	73	71	72	72	72	76	74	74	73	73	74	73	74	76	72	70
S.D.	1/14	12	12	12	12	12	13	12	13	11	10	8	10	11	12	12	12	12	12	13	11	8	6	10	12	11	10	11	10	11	11	10	
Sum	78	79	78	79	80	79	79	80	81	78	77	76	77	81	84	85	84	85	85	85	83	84	82	84	85	84	83	84	85	86	87	83	

1/ Standard deviation  
 2/ Average plus one standard deviation  
 Bureau of Agricultural Economics. Compiled from U. S. Weather Bureau Data.

S.D. 1/14 12 12 12 12 13 12 13 11 10 8 10 11 12 12 12 12 12 12 13 11 8 8 10 12 11 10 11 11 11 10 85  
 Sum 2/78 79 78 79 80 81 78 77 76 77 81 84 83 84 85 85 83 84 85 86 83 85 84 82 84 85 84 84 84 85 87 85

Table 9.- Temperatures, daily maximum for June, Hand County, S. Dak. 1902-39

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Ave.
Degrees Fahrenheit																															
1902	79	74	79	79	80	77	67	77	96	86	73	81	82	78	66	76	73	70	65	60	66	71	72	82	65	58	68	71	68	72	74
1903	71	72	77	83	85	87	85	72	65	67	75	81	86	92	76	80	94	90	83	75	74	79	83	75	82	84	87	93	82	82	81
1904	65	68	58	61	63	68	75	81	75	79	75	67	75	75	76	89	93	89	92	72	77	91	88	75	69	82	83	81	77	75	77
1905	82	82	96	87	85	60	70	74	74	69	78	80	93	83	68	64	70	65	75	84	64	64	57	64	65	66	72	78	81	81	75
1906	72	79	77	80	82	68	67	67	74	78	79	80	94	81	92	78	72	74	65	74	71	64	69	65	74	81	92	80	86	76	76
1907	75	69	72	58	73	68	61	61	66	71	78	75	68	77	90	87	85	73	82	85	87	82	87	77	75	78	82	90	89	81	77
1908	66	60	72	73	78	86	79	66	62	73	87	89	68	70	68	69	80	80	82	87	93	73	72	84	83	84	85	77	80	74	77
1909	71	75	84	82	79	71	69	59	71	70	78	73	62	72	81	83	81	85	92	91	86	86	82	75	78	89	82	90	92	92	79
1910	73	66	60	64	59	69	67	60	61	80	82	83	86	89	94	92	91	93	95	98	100	95	95	81	77	85	87	88	91	92	82
1911	83	93	92	89	83	80	88	99	100	84	79	84	79	86	93	82	87	92	96	97	102	106	91	100	100	85	75	85	102	104	91
1912	83	90	76	64	71	70	65	62	84	88	77	72	81	72	75	65	66	70	82	78	77	82	89	95	99	92	97	100	102	97	80
1913	80	85	72	82	91	66	66	67	69	75	84	86	80	92	91	89	98	97	90	84	87	89	98	90	88	92	101	100	90	88	86
1914	79	82	95	88	80	86	81	85	83	74	73	69	75	74	77	75	80	92	70	75	72	78	90	65	70	85	90	65	70	82	79
1915	73	70	69	78	76	60	68	63	69	77	65	72	73	78	77	60	52	74	84	75	78	80	84	78	84	85	86	78	73	75	73
1916	64	72	77	77	77	67	68	70	78	70	75	69	77	76	69	73	69	69	72	62	65	82	68	69	84	74	77	88	85	86	74
1917	69	72	69	60	58	58	77	74	85	86	76	61	70	70	75	90	97	75	84	79	69	80	86	73	85	76	89	88	85	90	77
1918	72	75	77	75	83	70	69	92	90	98	82	86	91	88	95	79	79	78	89	75	85	88	81	92	85	82	76	60	88	81	81
1919	57	75	55	53	66	69	77	76	61	77	77	86	87	82	89	89	91	86	81	77	85	99	86	91	95	90	87	82	87	92	80
1920	65	70	55	66	70	80	88	93	84	75	93	92	93	74	69	76	70	74	73	73	75	80	78	78	75	70	75	89	84	77	77
1921	82	71	65	70	75	87	75	78	90	95	85	92	88	90	90	92	95	95	92	90	90	100	102	98	95	101	103	93	103	89	89
1922	72	70	80	85	93	90	84	71	71	66	78	90	82	84	81	69	82	80	80	85	90	95	93	76	73	76	80	78	74	80	80
1923	89	90	91	85	80	71	75	65	61	56	71	75	78	76	82	86	86	85	82	90	85	90	84	97	82	84	69	65	74	69	79
1924	64	66	62	67	62	61	51	62	64	63	64	68	80	79	73	83	76	72	70	72	86	77	72	71	75	75	70	63	66	70	70
1925	78	63	76	88	69	73	78	69	66	63	69	72	76	72	78	75	88	85	90	95	80	95	80	70	69	81	77	70	75	78	88
1926	74	68	67	76	89	83	77	81	92	97	90	84	74	67	68	72	68	68	76	77	74	76	88	78	76	82	98	104	99	93	81
1927	55	65	74	63	69	71	85	84	80	75	72	65	72	72	73	69	74	83	90	77	71	75	87	89	82	88	103	96	92	86	70
1928	75	75	78	77	76	83	87	78	87	80	68	71	80	85	87	82	74	69	78	74	72	73	66	69	75	77	82	75	73	88	77
1929	71	60	61	69	75	75	78	77	90	91	86	64	80	83	92	87	92	82	89	80	80	76	83	73	80	78	83	82	101	90	80
1930	76	85	77	75	69	71	71	75	75	78	77	79	80	79	77	75	79	82	78	86	98	91	85	86	78	84	85	94	84	73	80
1931	93	91	85	73	75	71	73	95	95	83	75	84	89	82	80	94	99	96	97	80	78	87	97	95	99	107	109	112	107	108	90
1932	82	77	73	82	84	84	89	84	81	75	77	74	75	84	83	76	75	79	62	78	78	85	86	92	85	76	85	81	84	81	81
1933	100	93	98	98	101	90	93	85	96	101	84	76	76	92	100	102	101	104	103	100	89	96	94	94	101	105	104	102	100	95	96
1934	94	94	89	80	79	78	79	87	85	86	86	81	92	76	74	73	78	95	95	88	85	95	94	92	94	96	96	92	92	90	84
1935	78	77	69	69	60	62	72	80	83	82	81	81	96	94	85	87	69	73	73	74	75	84	82	80	79	91	85	81	85	81	81
1936	80	79	58	69	65	69	79	82	81	72	79	83	98	91	104	102	85	92	92	89	81	78	88	100	105	100	101	105	101	89	67
1937	65	65	80	78	55	58	63	62	58	62	67	65	65	76	73	75	83	81	77	82	86	94	101	96	87	82	81	80	87	86	76
1938	75	83	76	78	90	85	70	76	75	72	72	80	81	82	81	81	88	84	81	86	94	91	87	84	70	76	78	73	85	83	81
1939	77	63	72	88	93	86	80	84	83	68	64	86	74	72	72	78	91	88	74	76	77	80	90	87	81	82	90	81	79	78	79
Ave.	75	75	75	75	77	74	75	75	77	77	77	78	80	80	81	81	82	82	82	81	81	83	84	83	83	83	85	86	86	83	80

1/ Standard deviation  
 2/ Average plus one standard deviation  
 Bureau of Agricultural Economics. Compiled from U. S. Weather Bureau Data.



Table 10.-- Temperatures, daily maximum for July, Hand County, S. Dak. 1902-39

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Ave.
Degrees Fahrenheit																																
1902	82	81	91	84	86	83	84	73	74	79	86	95	84	88	93	87	73	75	74	79	86	87	91	96	86	86	88	92	103	89	92	85
1903	86	84	71	73	87	97	93	78	83	85	83	79	81	86	86	87	83	85	85	92	90	89	92	101	87	87	94	82	72	71	70	84
1904	80	83	76	86	65	73	71	77	90	82	87	89	84	82	94	92	91	85	85	82	87	77	84	87	90	82	77	95	97	85	80	84
1905	81	73	67	79	79	77	69	79	81	83	88	88	93	95	87	95	85	85	83	78	85	73	73	75	77	81	81	78	82	79	75	81
1906	83	73	81	84	84	85	87	92	94	95	84	85	85	73	72	70	79	87	92	98	101	80	80	93	99	90	89	87	88	81	91	86
1907	75	90	92	96	86	80	85	75	82	73	83	92	90	74	80	81	77	90	81	83	80	83	89	85	80	77	73	82	86	84	85	83
1908	75	77	81	89	80	69	83	92	98	101	87	89	83	83	91	100	77	80	86	89	87	87	80	91	94	92	90	93	94	80	87	87
1909	94	90	76	82	60	70	69	82	79	83	78	75	83	79	82	80	95	92	97	98	83	79	85	90	81	85	84	93	85	85	91	83
1910	98	81	91	92	95	91	92	82	80	87	69	81	90	91	97	104	84	92	94	98	86	89	92	95	98	90	79	90	90	88	103	89
1911	107	88	104	88	88	87	103	87	91	87	86	90	92	95	83	82	71	85	81	85	87	69	92	96	76	82	90	99	100	102	80	89
1912	90	81	83	88	83	92	96	89	83	89	89	83	83	79	95	75	77	65	68	91	91	92	92	92	92	87	89	90	99	88	86	83
1913	81	90	79	82	85	91	95	96	83	83	76	84	84	87	89	87	79	87	84	79	87	77	80	80	87	97	83	89	102	83	92	88
1914	84	67	89	89	80	84	81	91	95	96	101	87	90	95	99	83	84	92	87	93	100	80	89	97	100	106	102	98	92	93	91	92
1915	76	70	67	68	72	81	77	71	85	83	85	90	88	85	84	75	63	75	73	75	80	80	83	74	75	66	70	78	88	85	81	78
1916	92	88	94	90	95	93	95	94	94	99	84	91	90	93	88	81	83	102	86	90	95	91	89	78	97	100	101	108	83	87	93	90
1917	79	75	76	84	87	93	93	92	86	104	85	85	79	85	81	85	85	90	97	102	99	94	94	95	96	102	98	108	107	80	86	90
1918	86	88	97	86	84	71	67	80	75	78	80	73	90	77	84	77	87	92	96	95	86	78	84	87	78	76	94	81	76	85	99	84
1919	95	95	86	87	86	86	81	94	82	85	82	85	85	89	89	93	100	97	85	82	88	94	90	85	99	111	86	93	99	83	82	90
1920	85	95	87	90	70	83	70	89	82	73	96	92	75	90	90	85	97	92	100	89	88	100	97	78	71	80	85	88	87	92	75	86
1921	97	98	74	85	70	87	87	96	98	88	95	94	93	87	85	97	94	89	85	92	97	93	96	92	94	91	88	85	93	85	80	90
1922	71	72	77	86	83	66	76	84	75	70	72	77	85	92	90	76	77	79	92	91	90	86	88	85	81	84	83	85	86	94	86	82
1923	76	74	82	76	86	83	93	95	88	81	84	81	88	82	83	88	81	91	94	87	93	97	88	86	84	80	81	92	90	76	89	86
1924	68	67	70	70	78	79	81	79	72	87	86	73	72	72	80	73	74	70	82	81	82	82	82	69	69	80	79	79	92	83	83	78
1925	85	83	80	85	95	94	84	80	84	97	93	100	99	97	94	83	86	97	89	78	78	74	94	84	80	91	74	74	78	71	80	86
1926	85	85	90	83	88	93	94	95	77	75	95	90	85	83	101	102	95	109	104	98	78	81	81	80	83	84	87	88	86	89	96	89
1927	74	70	74	90	87	84	84	90	86	91	85	85	80	88	88	85	82	77	75	88	77	80	86	81	84	92	95	84	80	83	82	83
1928	88	83	82	90	93	89	83	76	86	85	82	84	85	91	95	97	85	84	80	87	82	82	83	87	92	73	75	78	81	83	89	85
1929	87	93	99	92	87	82	81	71	83	88	93	105	90	80	86	94	95	86	86	100	102	91	94	98	99	103	96	91	95	100	89	92
1930	83	91	95	88	98	96	102	100	102	106	108	100	78	83	98	106	98	98	96	85	83	90	95	100	103	105	103	87	89	88	92	95
1931	90	81	89	80	92	90	79	80	86	93	92	85	96	107	113	108	100	101	96	95	94	96	92	101	109	106	110	99	85	99	103	95
1932	74	77	84	69	79	83	77	89	89	81	95	95	92	94	92	98	98	102	103	96	98	98	98	98	94	96	92	86	85	82	90	84
1933	90	90	96	96	95	92	74	88	96	96	97	94	98	94	82	85	84	95	98	95	86	86	80	85	96	95	105	105	107	106	93	93
1934	101	90	85	86	82	74	81	79	91	92	97	85	95	95	88	91	103	104	103	111	101	110	102	95	89	80	88	92	88	87	92	92
1935	88	100	99	98	92	91	91	90	95	97	91	89	88	96	94	94	94	84	96	102	83	92	90	94	99	106	99	103	98	89	98	94
1936	87	101	95	104	107	108	102	101	109	108	105	101	97	97	104	111	110	101	101	96	95	107	101	105	101	99	93	92	87	90	95	100
1937	89	92	93	94	94	103	103	95	97	100	94	95	92	78	80	78	74	81	88	95	97	97	93	94	82	90	89	86	90	94	91	91
1938	92	95	93	89	92	89	82	86	92	89	93	95	91	85	97	92	89	93	89	85	84	85	96	91	81	82	84	91	88	91	99	90
1939	82	92	86	93	87	85	84	90	87	95	101	99	95	91	89	85	80	86	90	93	88	86	93	86	92	96	94	87	94	38	93	90
Ave.	85	85	85	86	85	85	85	86	87	89	89	89	87	87	90	89	87	89	89	90	89	88	89	89	88	88	90	89	90	88	88	88
S.D.	1/8	9	9	9	9	9	9	9	8	9	9	7	6	8	8	9	9	9	9	9	9	7	8	7	8	9	10	9	7	8	7	8
Sum	2/93	94	94	95	94	94	94	95	95	98	98	96	93	95	98	98	96	98	98	98	99	96	96	96	97	97	100	98	97	98	95	96

Standard deviation

Average plus one standard deviation

Bureau of Agricultural Economics. Compiled from U. S. Weather Bureau Data.

S.D.	1/8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Sum	2/93	94	94	95	94	94	94	95	95	98	98	96	93	95	98	98	96	98	98	99	96	96	96	96	97	97	100	98	97	98	95	96



Table 11.- Temperatures, daily maximum for August, Hand County, S. Dak. 1902-39

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Ave.	
Degrees Fahrenheit																																	
1902	95	86	78	92	81	91	86	81	82	67	81	83	87	74	80	76	90	92	77	76	72	79	83	77	82	81	84	83	74	64	75	81	
1903	71	75	89	87	83	81	72	77	78	69	75	75	79	78	83	90	93	86	85	98	95	92	86	80	74	70	65	60	74	87	80		
1904	76	90	97	85	83	77	74	79	74	83	98	98	88	101	93	86	77	72	86	88	87	86	97	86	75	93	94	75	78	77	84	84	
1905	80	79	89	91	83	83	94	88	95	98	79	77	78	78	75	78	76	81	80	94	86	94	80	77	83	95	93	96	85	76	81	84	
1906	90	82	79	71	78	81	78	73	82	81	80	85	90	88	94	98	93	88	97	81	74	76	62	65	75	70	79	72	72	83	82	81	
1907	75	79	82	88	82	89	83	89	93	98	101	81	89	84	91	85	98	94	91	72	78	84	92	82	85	87	89	80	85	83	95	84	
1908	101	107	91	88	92	80	83	97	81	83	82	83	68	60	70	89	80	90	73	82	74	72	74	69	85	76	86	87	94	98	78	83	
1909	97	95	87	94	93	95	76	75	85	92	94	93	93	92	97	98	86	85	88	90	94	81	96	85	88	95	77	82	89	74	89		
1910	97	95	86	87	87	74	88	83	82	92	94	97	78	85	83	80	75	82	99	99	97	87	82	66	74	90	94	83	89	80	78	86	
1911	84	72	77	79	76	78	80	92	72	74	74	81	93	106	82	90	85	87	89	80	65	67	64	81	80	68	69	80	92	98	81		
1912	80	78	75	80	94	87	83	79	79	85	90	87	89	85	84	77	84	81	82	78	84	83	98	97	101	76	93	78	78	72	80	84	
1913	99	107	94	95	88	87	84	87	75	88	78	96	99	88	91	89	91	90	103	84	86	86	88	98	92	97	86	93	89	95	91		
1914	77	92	102	94	84	91	104	95	82	74	67	95	86	89	108	98	85	81	90	89	84	79	80	88	52	61	78	86	90	82	85		
1915	76	63	70	74	85	85	82	82	85	85	85	85	88	89	85	88	75	72	78	82	83	83	68	76	79	73	76	75	67	77	87	79	
1916	91	100	100	87	89	86	90	93	98	80	86	88	70	81	94	94	95	95	85	67	67	80	91	81	70	74	80	85	77	85	82	84	
1917	87	84	87	82	82	76	69	71	78	82	73	84	85	87	92	89	93	89	93	92	97	88	80	83	92	98	79	80	80	92	82	85	
1918	93	87	98	94	80	87	87	79	91	87	85	87	81	83	82	89	87	86	94	89	91	92	90	97	85	98	68	90	79	86	87		
1919	82	85	92	88	99	95	91	86	81	87	94	94	92	98	89	90	90	93	91	87	94	96	81	85	80	80	72	84	85	78	82	86	
1920	75	85	90	90	91	84	89	94	92	90	79	83	84	83	85	85	90	82	83	80	79	85	89	90	85	85	83	70	70	84	79	84	
1921	76	84	89	92	86	78	83	94	100	94	83	93	80	78	77	86	80	98	94	81	84	85	82	86	93	103	91	92	96	87	87	88	
1922	92	83	82	81	88	84	78	83	82	89	95	97	96	94	95	97	91	91	94	93	89	91	100	93	86	83	93	80	77	87	84	89	
1923	82	70	81	72	80	81	74	80	82	80	82	80	82	91	88	78	80	84	91	88	85	75	71	82	80	82	75	78	74	85	85	84	
1924	82	88	88	89	80	77	85	70	73	74	82	75	80	95	78	74	76	78	78	85	88	82	82	85	90	95	93	90	98	95	80	73	83
1925	84	90	96	98	95	97	100	89	86	88	78	83	85	96	93	97	97	92	85	78	91	101	107	103	82	93	95	98	89	85	81	91	
1926	98	97	82	72	97	82	75	86	75	69	86	77	73	80	90	85	76	78	80	83	92	82	80	87	102	94	99	82	79	91	90	84	
1927	70	75	80	89	94	87	88	72	87	82	83	84	84	85	78	76	70	72	75	81	88	73	73	81	87	83	86	93	93	87	82		
1928	87	80	78	83	78	88	96	95	98	91	97	104	104	103	101	90	78	94	90	77	88	88	74	82	79	81	75	76	72	68	76	88	
1929	86	88	84	90	91	90	93	86	97	93	97	90	82	79	97	93	91	93	87	94	104	92	102	106	88	87	97	88	88	91	90	91	
1930	109	105	104	93	95	96	94	100	92	81	82	92	92	98	98	85	79	76	77	75	74	80	79	84	88	93	84	72	84	94	89	88	
1931	90	81	100	106	93	81	92	85	80	68	81	93	105	92	91	94	92	100	93	93	90	97	89	83	82	92	86	72	81	82	77	89	
1932	84	83	98	98	96	86	86	90	92	88	86	80	78	84	97	95	90	78	86	96	90	97	98	95	83	84	78	79	97	93	77	89	
1933	80	80	81	84	90	98	95	95	98	92	98	94	90	91	88	87	85	88	88	83	77	77	77	76	78	77	73	74	81	85	90	85	
1934	93	92	96	110	93	97	97	102	83	81	81	88	85	88	86	92	96	97	81	84	81	72	71	79	83	78	77	83	87	84	88		
1935	96	87	84	96	91	95	95	85	95	103	93	83	92	105	102	86	89	95	91	73	85	92	92	89	80	80	71	69	69	66	65	86	
1936	103	97	75	73	84	94	95	105	99	89	105	93	89	94	100	92	84	95	90	80	83	88	98	90	83	80	81	75	77	78	86	89	
1937	101	85	88	98	104	100	99	97	103	86	85	92	99	103	109	102	84	86	87	80	79	95	92	95	93	95	94	93	83	67	90	93	
1938	99	106	101	98	95	90	89	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	92	87	
1939	92	88	88	86	91	90	84	78	75	71	78	84	95	92	95	95	93	94	89	77	89	86	81	89	87	93	93	94	90	89	81	88	
Ave.	88	87	88	88	88	87	86	87	87	85	84	87	87	89	90	88	86	87	88	85	86	86	85	84	84	84	84	81	83	84	84	86	
S.D.	1/10	9	9	9	7	7	9	9	9	9	9	8	9	9	9	9	7	8	7	6	8	8	8	10	9	8	10	10	9	9	8	7	
Max	98	97	97	97	95	94	95	96	98	94	93	95	96	98	99	95	94	94	92	93	93	94	95	93	92	94	94	90	92	92	91		

1/ Standard deviation

2/ Average plus one standard deviation

Bureau of Agricultural Economics. Compiled from U. S. Weather Bureau Data.

Table 12. - Frost free periods, Hand County Area, South Dakota

Station	: Years	: Last frost	: First frost	: Frost
	: reported	: in spring	: in fall	: free days
		: <u>Average date</u>	: <u>Average date</u>	: <u>Average number</u>
	:	:	:	:
Miller	: 37	: May 11	: September 29	: 141
Faulkton	: 44	: May 10	: September 28	: 141
Redfield	: 40	: May 10	: September 27	: 140
Huron	: 58	: May 7	: September 23	: 139
Gann Valley	: 36	: May 10	: September 25	: 138
Highmore	: 46	: May 13	: September 27	: 137
	:	:	:	:
All stations	: :	: May 10	: September 26	: 139
	:	:	:	:

Compiled from U. S. Weather Bureau data.

Table 13. - Tentative annual estimates of rust losses of wheat in selected states, 1909 to 1936

Year	North Dakota		Minnesota		South Dakota		Nebraska	
	1,000		1,000		1,000		1,000	
	Bu.	Pct.	Bu.	Pct.	Bu.	Pct.	Bu.	Pct.
1909	0	0.0	0	0.0	0	0.0	0	0.0
1910	154	.1	30	T	262	.4	19	T
1911	10,897	6.3	3,432	5.5	446	.8	0	.0
1912	1,053	.6	3,798	4.7	639	.8	232	.3
1913	0	.0	0	.0	0	.0	0	.0
1914	10,498	7.2	5,792	9.7	7,199	12.9	250	.3
1915	10,225	5.7	957	1.4	3,421	5.0	968	1.1
1916	71,444	45.2	12,087	23.0	20,207	37.1	2,039	2.6
1917	282	.2	755	1.4	1,267	2.2	35	.1
1918	1,205	.7	1,419	1.9	1,227	1.9	665	.9
1919	24,744	16.4	15,290	20.4	10,512	16.4	9,584	10.8
1920	26,503	17.0	15,194	29.9	14,170	27.4	12,129	14.5
1921	19,889	10.7	5,512	13.1	3,579	7.2	2,139	2.7
1922	10,303	6.3	2,787	7.7	1,343	2.6	332	.4
1923	29,267	21.4	3,476	10.4	7,400	17.6	8,866	14.8
1924	4,444	3.0	558	1.4	610	1.4	340	.5
1925	6,809	4.6	5,368	12.7	1,896	4.2	158	.3
1926	1,980	1.2	1,163	3.6	212	.5	75	.1
1927	25,038	13.5	5,956	18.2	5,465	8.9	1,283	1.5
1928	3,966	2.0	551	2.1	618	1.1	427	.5
1929	2,025	1.1	1,037	3.5	1,027	1.8	1,460	1.8
1930	2,162	1.1	789	2.4	433	.6	1,212	1.2
1931	5,607	10.4	1,819	10.1	2,912	8.5	114	.2
1932	12,376	10.0	1,005	4.6	1,097	2.0	1,398	5.0
1933	721	1.0	83	.5	29	.5	0	.0
1934	3,064	12.0	1,253	10.0	0	.0	174	1.0
1935	58,832	50.0	9,475	30.0	12,779	25.0	9,342	20.0
1936	0	.0	0	.0	0	.0	47	.1
Average	12,267	8.85	3,557	8.15	5,527	6.67	1,905	2.88

Selected from a table prepared by Bureau of Plant Industry, U.S.D.A., showing "Tentative annual and average estimates of rust losses in bushels and in percentage of the total loss of wheat in 29 wheat producing States of the United States during the 28 year period from 1909 to 1936, inclusive, arranged in order of their average loss". These are the four states having the highest average rust losses.





